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CATHODE-RAY AND ROENTGEN-RAY WORK IN PROGRESS*

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(1) INTRODUCTION

IN 1894 Lenard[1] produced a cathode-ray tube differing from its predecessors in that it permitted the cathode rays to pass through a very thin metal foil window out into the air.

Last year the author presented a paper[2] showing how the original Lenard tube could be modified so as to permit of the use of considerably higher voltages. The tube described in detail in the article in question had been used for voltages as high as 250,000 (max.), and reference was made to a larger model which had been used for voltages up to 350,000. In discussing the possibility of realizing a cathode-ray tube for still higher voltages, it was suggested in that paper that a method of cascading might be successfully employed.

It is the main purpose of the present paper to discuss the experiments which have since been carried out on the subject of cascading.

As a result of these experiments, it has been found possible to construct a cathode-ray tube for at least 900,000 volts, and it would seem as though the method employed should lend itself to the production of a tube capable of operating at as high a voltage as can be produced.

The cascade method can be used equally well for the production of very high voltage roentgen-ray tubes.

(2) IMPROVED DESIGN OF SINGLE SECTION CATHODE-RAY TUBE

Before undertaking work in earnest on the cascade system, it seemed desirable to give further study to the design of the simple, single section, cathode-ray tube, which was later to serve as a unit of the cascade system. In this way only could the number of sections required for a given voltage, and hence the complexity of the system, and the overall length of the composite tube, be reduced to a minimum.

The tube previously described in detail (*loc. cit.*, pp. 695–703) had a bulb 20 cm. in diameter, an overall length of 89 cm. and

[1] Lenard, P. *Ann. d. phys.*, 1894, li, 225–267.
[2] *J. Franklin Inst.*, 1926, 693–721.
* Read at the Twenty-eighth Annual Meeting, AMERICAN ROENTGEN RAY SOCIETY, Montreal, Canada, Sept. 20–23, 1927.

electrodes having a radius of curvature, at the edges of the co-operating faces, of 1.6 mm.

Under favorable conditions of vacuum and of electrical excitation, this tube could be operated with as much as 250,000 volts, but when this potential difference was exceeded, the tube would carry an appreciable current even when the filament was not lighted. This current would be unsteady and the major portion of the cathode-ray discharge would go to the glass bulb, as indicated by the fluorescence of the latter, rather than in the desired direction, towards the window. This cathode-ray discharge emanated from the edge of the cathode focusing device and was present, and to the same extent, whether the filament was lighted or not. Under less favorable operating conditions the same effect was observed at lower voltages. Continued operation at a voltage sufficient to produce unsteady operation of the tube resulted in puncturing of the glass.

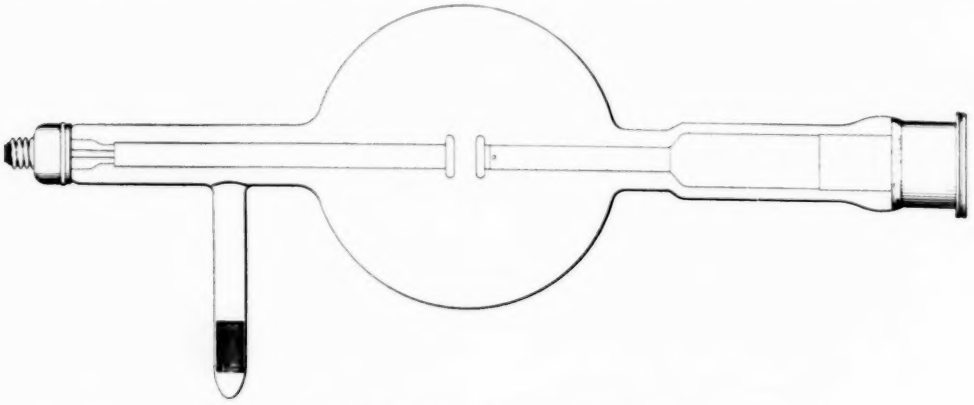

FIG. 1. Cathode-ray tube for 300,000 volts.

A larger model of the tube was made, with a 30.5 cm. bulb, an overall length of 155 cm. and larger electrodes having a radius of curvature at the edges of the co-operating faces of 6.3 mm. This model operated better at 300,000 volts than the earlier one did at 200,000. A later model, differing from the last only in that its overall length had been reduced to 89 cm., was found to be still better. This model is shown in Figure 1.

It is interesting to note that while the performance of the tube had been greatly improved by increasing the size of both the bulb and the electrodes, no improvement was to be seen when either one of the changes was made singly.

It seemed reasonable to hope that further progress might be made by a further simultaneous increase in the size of bulb and electrodes. The bulb diameter was therefore increased to 51.5 cm., and the diameter of the electrodes was correspondingly increased. The overall length was 155 cm. As yet it has not been possible to operate this tube at as high voltages as can be carried by the design of Figure 1. This may be due to the greater difficulty of freeing its very large electrodes sufficiently from gas.

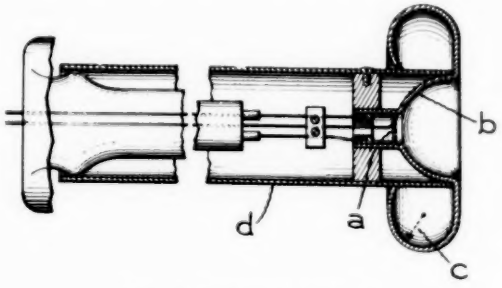

FIG. 2. Section of cathode.

At the moment, then, the best design evolved for a single section cathode-ray tube is that shown in Figure 1. Tubes of this design can be operated readily at 300,000 volts and, under more favorable conditions, at as much as 350,000 volts.

In Figure 1, which is to scale, the bulb is 30.5 cm., in diameter and the overall length is 89 cm. The cathode, at the left, is shown in section in Figure 2, and consists of the flat tungsten spiral, *a*, located in a recess in the hemispherical copper cup, *b*. The outer edge of *b* is spun over into a ring of essentially circular section having a radius, *c*, of 6.3 mm. The copper tube, *d*, serves to support the cathode and to shield the filament leads.

The anode shield, *e*, is made of thin copper and is supported, as shown in Figure 3, by the flange, *f*, which is copper-brazed to the inside of the invar ring, *g*.

The window support, *h*, consists of hexagonal cells of sheet molybdenum, all copper-brazed together and to the surrounding molybdenum frame.

The window is 0.0127 mm. thick and made of "No. 4 Resistal," an alloy consisting of about 18 parts by weight of chromium, 3 of silicon, 0.2 of carbon, 43.8 of iron and 35 of nickel.* "Resistal" is a much better window material than the nickel used in the earlier tubes, for the following reasons: It is easier to roll into thin foil free from holes; it is so hard that dust particles caught between the window and its cellular support do not punch holes in the window, and finally, it can be operated at a higher temperature without causing harmful oxidation or mechanical rupture. In tinning it, preparatory to its attachment to the window frame, it is necessary to use ammonium chloride instead of the ordinary soldering flux.

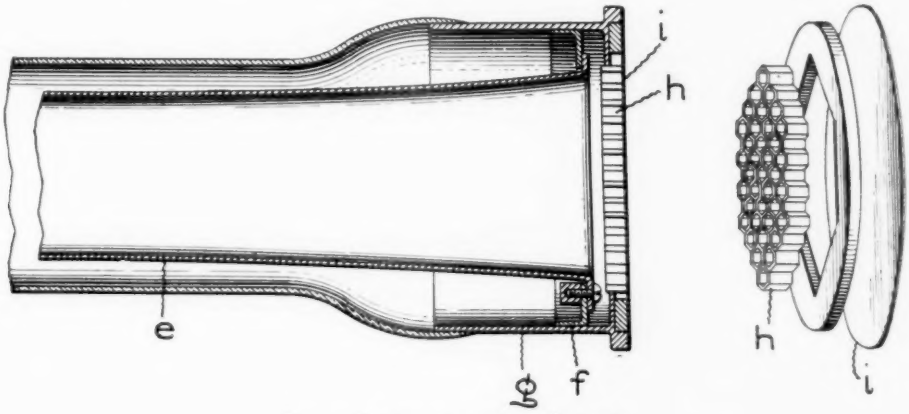

FIG. 3. Section of anode end of tube.

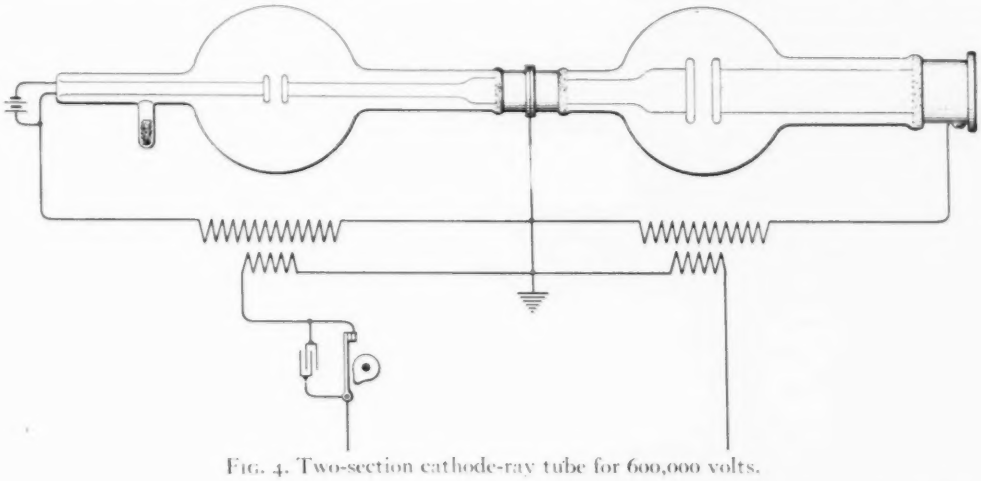

FIG. 4. Two-section cathode-ray tube for 600,000 volts.

*The use of this particular alloy was suggested by Mr. Parkman Coffin.

The required high vacuum is maintained by means of charcoal in the side tube, which, during operation of the tube, is kept immersed in liquid air; or the tube may be kept connected to a suitable pump system.

(3) A TWO-SECTION (CASCADE) CATHODE-RAY TUBE FOR 600,000 VOLTS

A successful two-section tube is shown diagrammatically in Figure 4 and, from a photograph, in Figure 5. The first (left hand) section is exactly the same as

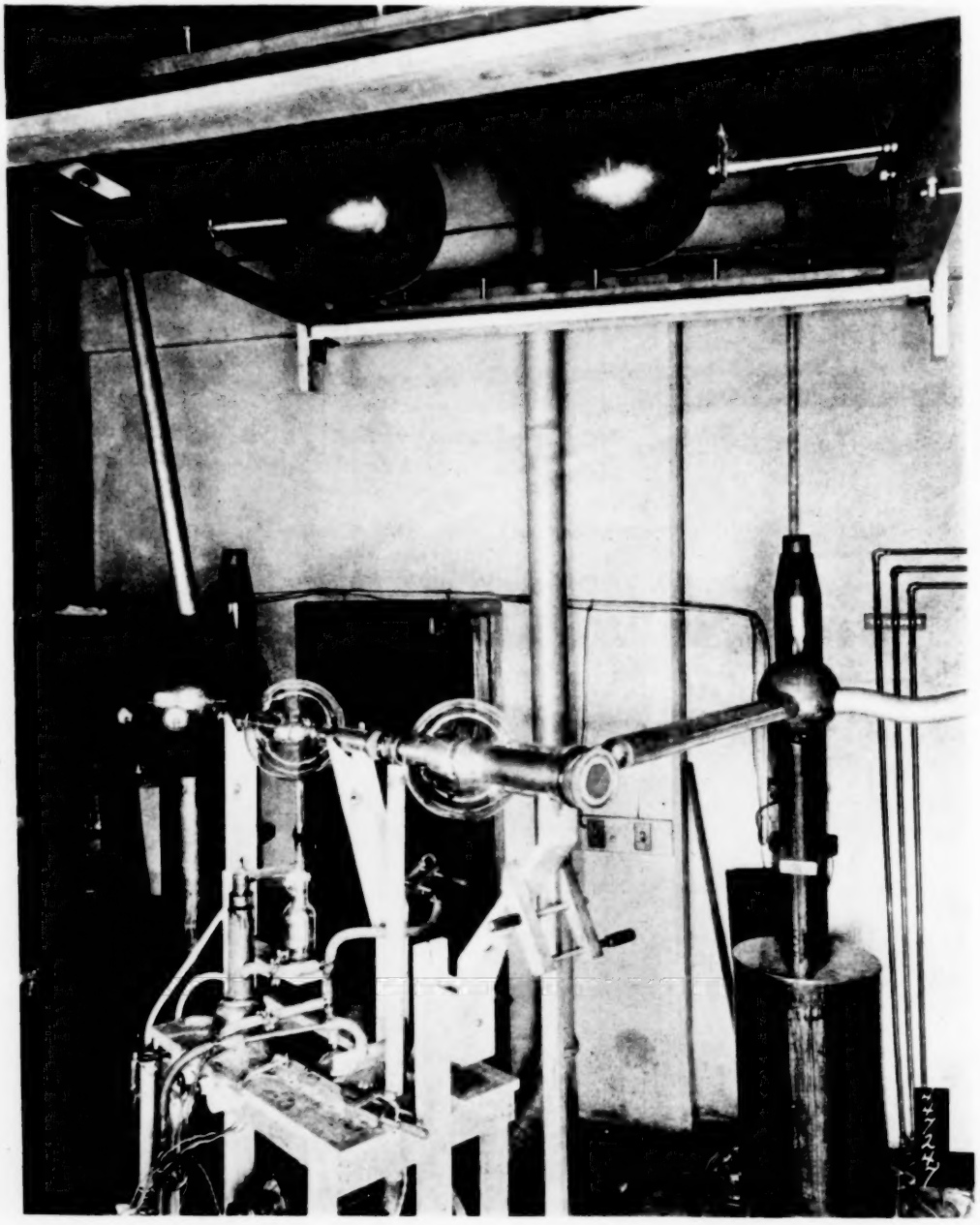

FIG. 5. Tube of Figure 4 attached to exhaust system and connected to 2-unit induction coil, with sphere-gap overhead for measuring voltage.

the tube of Figure 1 except that the window and window support have been omitted and the metal flange at the anode

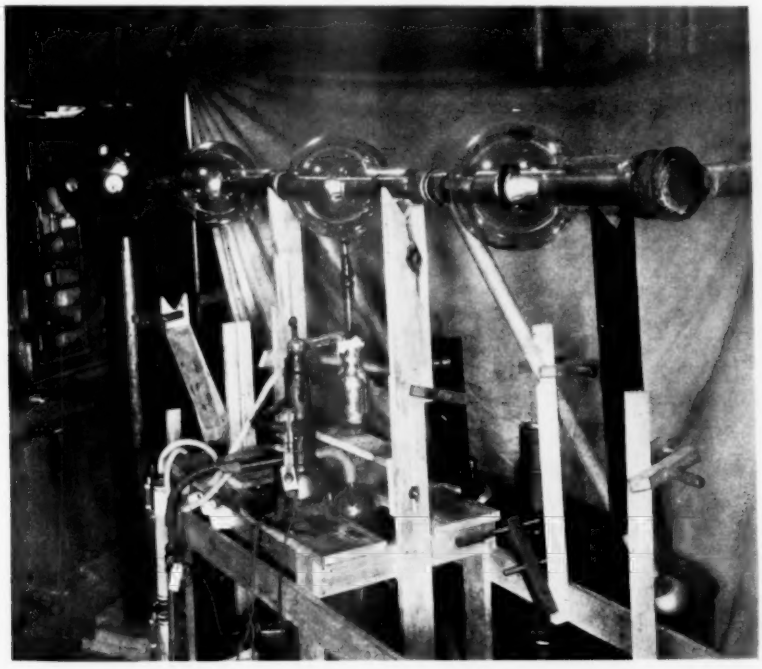

Fig. 6. Three-section cathode-ray tube for 900,000 volts.

end of this section has been attached with soft solder to the mental flange of the cathode end of the second section.

In the second section, the cathode arm has been made 18 cm. shorter than in the first section, and it would doubtless be permissible to shorten the cathode arm of the first section by this same amount.

The increase in the diameter of the tubular electrodes of the second section over that of the first is to prevent the conical, divergent beam of cathode rays from striking them. The second section is provided with a window support and window.

As the anode of the first section is electrically connected to the cathode of the second section, the composite tube may be considered as having three electrodes which may be referred to as a cathode, intermediate electrode and anode. Experiment shows that the tube will stand the highest voltage when the applied potential difference is divided equally between the two sections, as is accomplished by connecting the intermediate electrode to the electrical center of the high tension circuit.

Experience has shown that the two-section tube operates as well at 600,000 volts (max.) as the single-section tube operates at 300,000 volts.

Figures 4 and 5 show the two-section tube connected to an induction coil. The latter itself is seen to consist of two sections which are operated with their secondaries in series. The large hollow metal sphere at the left of the tube in Figure 5 contains the storage battery for lighting the filament, the filament rheostat, an ammeter in the filament circuit and a milliammeter for measuring the high tension current passing through the tube. (The sphere is supported by an insulating tube of paper—bakelite.)

In Figure 5 the pump connection is made at the center of the bulb of the first section. Experience has shown, however, that it is far preferable to attach the pump connection to a short, cylindrical metal tube inserted at the junction of the

two sections. In this way, the pump system, which is naturally grounded, is electrically connected to the intermediate electrode which is also grounded. As a result, all discharges to the pump system are prevented.

In Figure 5 the sphere-gap (with 50 cm. spheres) used for measuring the voltage, is mounted above the tube.

The vertical type induction coil shown in Figure 5 is in two units, one of which is standing on the floor at the extreme right and the other at the left behind the battery container and its support. It is oil filled and tension circuit of the induction coil. As the coil was all built, however, and had no taps, it was simpler to use the small, two-section, induction coil shown standing on the floor, at the extreme right in Figure 6, to maintain the intermediate electrodes at the proper potentials. The primary of this coil was connected in series with the primary of the big coil and its output was controlled by means of a variable resistance shunted around its primary.

The only trouble experienced with this tube has been an occasional puncturing of the glass side tube connecting it with the

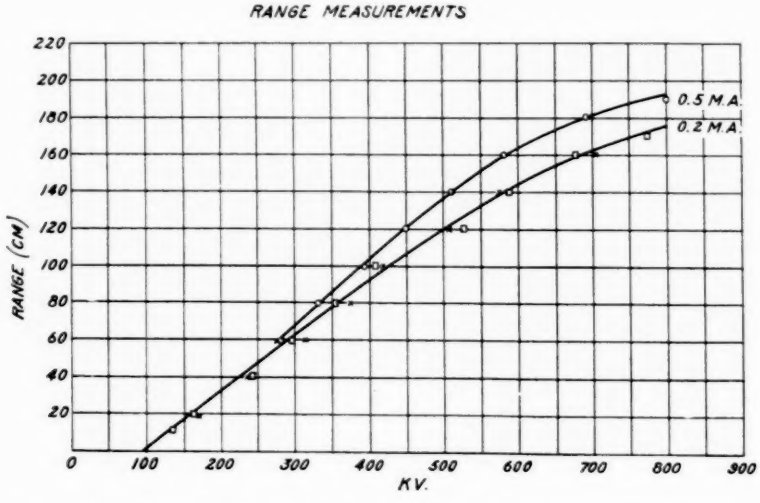

Fig. 7. Range of cathode rays in air as determined by fluorescence of lime.

one end of the secondary of each unit is connected to ground. The primaries are in series and operated from a mercury turbine interrupter.

(4) A THREE-SECTION (CASCADE) CATHODE-RAY TUBE FOR 900,000 VOLTS

Figure 6 shows a three-section tube, which has been operated successfully up to 900,000 volts (max.). The overall length of this composite tube is 326 cm. In this case also it has been found that the tube will stand the highest voltage when the potential difference is equally divided between the individual sections. The simplest method for accomplishing this result would have been to connect the two intermediate electrodes to suitable taps in the high pump. Such puncturing occurs only when the tube is operated with too poor a vacuum, and at that time takes place only because, with the odd number of sections, it is necessary to connect the pump to the center of the middle bulb rather than to a grounded intermediate electrode. This point is of sufficient importance so that one would always choose an even, rather than an odd, number of sections.

In the plan for cascading tubes outlined in the previous article[1] the use of a thin metal window between adjacent sections was contemplated. It seemed that, in the absence of such windows, positive ions present in the space between the electrodes of the last section would finally be caused

[1] *Loc. cit.*, pp. 719–721.

to impinge upon the cathode of the first section, and with a velocity corresponding to the full potential difference impressed upon the tube, and it was feared that the bombardment by such high velocity positive ions might cause the liberation of too many electrons from the cathode. The function of the intermediate windows was to stop such positive ions, while allowing the electrons, moving in the other direction, to pass.

It is interesting to note that such intermediate windows have not been found necessary with even as much as 900,000 volts. This would seem to indicate that the number of positive ions present is not sufficient to play an appreciable rôle in the discharge, and that the advantage gained by cascading lies not in holding down the velocity of any positive ions which may strike the cathode, but rather in limiting the potential gradient at the surface of the cathode.

With the tube shown in Figure 6, milliammeters placed at the two ends of the tube system do not indicate the same current. At 800,000 volts, when a meter placed in series with the cathode end of the tube indicates 1.0 ma., a meter in series with the anode end indicates 0.6 ma., while meters placed in series with the auxiliary electrodes both indicate 0.2 ma. of electron current flowing away from each of these electrodes. This is probably due, for the most part, to the intermediate electrodes having been made too small in diameter, so that they intercept a portion of the cathode-ray beam.

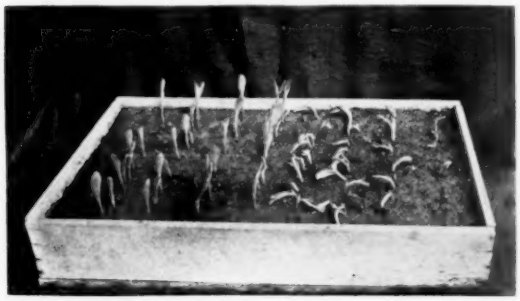

Fig. 8. Field corn. Seeds in first two rows from right irradiated 1 ma-sec.; those in next two rows 0.1 ma-sec.; those in next two rows 0.01 ma-sec., and those in last two rows (extreme left) unirradiated.

(5) Possibility of Constructing Cathode-Ray Tubes for Still Higher Voltages

As each section appears to be good for 300,000 volts, it seems reasonable to hope that a cascade type of tube can be developed for as high a potential difference as can be produced, and work will be continued along this line.

(6) Multi-Sectional (Cascade) Roentgen-Ray Tubes

Any one of the above mentioned cathode-ray tubes may be immediately transformed into a roentgen-ray tube by simply placing a suitable metal target outside of the tube in front of and close to the window. Or it may be made into a still more efficient roentgen-ray tube by replacing its window with a thicker piece of suitable metal and using this as a target. Or the entire window and shield assembly of the last section of the tube may be replaced by the ordinary roentgen-ray target and target support.

Fig. 9. Same as Figure 8, but eight days later.

(7) Range of High Voltage Cathode Rays

With the three-section tube of Figure 6 the range in the air has been roughly measured for different voltages by means of the fluorescence of a piece of lime, and the results are given in Figure 7. It is seen that the range appears somewhat greater when using a tube current of 0.5 ma. than when using 0.2 ma. This is inherent in the method, which will always give greater values the more sensitive the indicator

and the greater the cathode-ray intensity used. The data plotted in Figure 7 were obtained without shielding the lime from the roentgen rays coming from the tube and must be repeated later with suitable roentgen-ray shielding.

(8) COMMERCIAL USE OF CATHODE RAYS TO DIFFERENTIATE BETWEEN NATURAL AND ARTIFICIAL SAPPHIRE

Both natural and artificial sapphire has been tried for the bearings of electrical measuring instruments, but it has been found that the natural product wears better than the artificial. Both materials are on the market, but, up to this time, a good method has been lacking for differentiating between the two products. Recently it has been found that by cathode-ray bombardment one can easily distinguish between them, for the artificial sapphire continues to glow after the bombardment has stopped, while the natural sapphire does not.

(9) EFFECT OF CATHODE RAYS ON SEED CORN

When field corn seed was placed with the germ cell facing the window of the tube and irradiated for 10 milliampere-seconds at a distance of 2 inches with 200,000 volts it would not germinate.

With a certain smaller amount of radiation, germination took place, but as soon as the sprouts had emerged from the ground they bent over and curled around, as seen in the right hand half of Figure 8, in which the seed for the first two rows from the right had received 1 milliampere-second, the next two 0.1 milliampere-second, the next two 0.01 milliampere-second and the last two no treatment.

Figure 9 shows the same specimens eight days later. Other irradiated seed and controls planted in the open showed at first the same differences in behavior, but leaves appearing at a later period grew straight and the stalks grew as tall as those of the unirradiated controls.

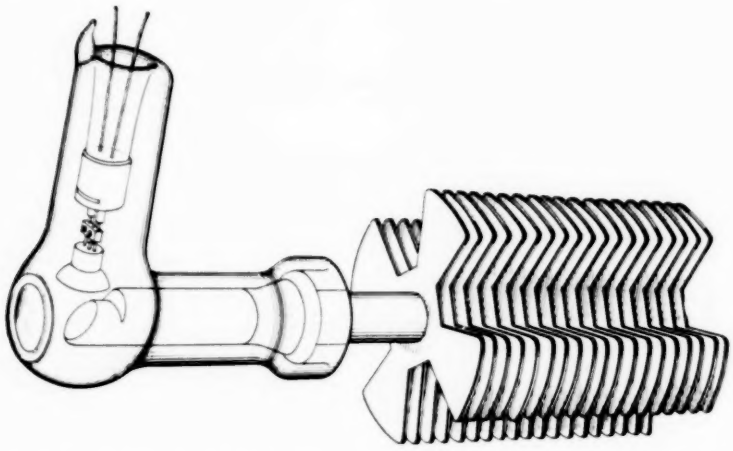

FIG. 10. Roentgen-ray tube, for 4000–10,000 volts, with thin ferro-chrom window.

(10) ACTIVATION OF YEAST BY CATHODE RAYS

Dr. Arthur Knudson has found that when yeast is subjected to cathode-ray bombardment, it becomes highly antirachitic just as it does when irradiated with ultraviolet light. It remains to be seen which of these two sources of radiation is the better adapted to the quantity production of vitamine D.

(11) A LOW VOLTAGE ROENTGEN-RAY TUBE WITH THIN METAL FOIL WINDOW

As a result of our experience with thin metal windows in cathode-ray tubes, it is now possible to build a low voltage

roentgen-ray tube in which the roentgen rays emerge through a thin window of chrom-iron alloy, which is sealed directly into the bulb. A tube of this type to operate from 4000 to 10,000 volts is being developed for experimental purposes, and is shown in Figure 10. The metal window has the advantage over Lindemann glass in that it is not deleteriously affected by the atmosphere and can easily be made of a definite and relatively uniform thickness.

ARTHRITIS AND THE RADIOTHERAPEUTIC MENOPAUSE*

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THE word menopause signifies the cessation of menstruation and also, as is indicated by the expressions "climacteric" and "change of life," implies a change in the whole makeup of the woman due to the absence of those substances which had been elaborated by the ovary, and possibly other organs, during the time when the menstrual function was active. Just what is lost is as yet imperfectly determined. The conclusion that something has been lost is based on the coincidence of certain phenomena with the cessation of menstruation. The circle encompassing these manifestations, which in early times included nearly all of the diseases and conditions occurring about the age of fifty, has gradually narrowed as the real causes have been established until now it includes only such little-understood manifestations as the neuroses, vasomotor phenomena and still more vague metabolic changes.

Among these, arthritic changes have recently attracted attention. Sensations and changes have occurred in the extremities of certain women so close to the time at which the periods ceased and of such a uniform picture that they seem to Cecil and Archer[1] to merit the term "menopause arthritis."

The determination of a causal relationship between sexual hormone deficiency and degenerative changes in women of an average age of fifty-two years is made difficult by the possibility that both conditions may be results of a common breaking-up process and not dependent on each other. An experiment is needed in which the reproductive function may be terminated without this complicating factor. An opportunity for such experimental study is furnished by the numerous cases in which the radiotherapeutic menopause has been induced for the treatment of uterine hemorrhage and benign tumors. The application of an adequate therapeutic dose produces in the ovary and uterus changes similar to those occurring with the natural menopause and is followed by the characteristic hot flashes. In such a group of cases a study of joint manifestations should throw some light on the general endocrine problem and should help in the practical estimation of the desirability of the radiotherapeutic menopause as a therapeutic procedure.

The records of 60 women who have had an artificial menopause have been studied. While the number is small, it is hoped that interest in this very large group may be stimulated. Of the 41 women over the age of forty, 21 have never had disturbances of the locomotor apparatus. Eleven had, prior to the establishment of the artificial menopause, symptoms of many kinds in the extremities. Five had vague stiffness, pain with or without motion, usually worse in the morning, and some limitation in usefulness although only one had definite limitation of motion. The hands, feet, wrists, elbows, and knees were affected but the description of the sensations left

* Read at the Twelfth Annual Meeting, AMERICAN RADIUM SOCIETY, Washington, D. C., May 16–17, 1927.

one in doubt as to whether the joints themselves or the soft parts were the seat of the trouble. Many complained of puffiness and a sense of swelling which prevented closing of the hands although when examined there was no objectively appreciable swelling. Two women had acute joint attacks following infection (pneumonia, uterine infection). Two had symptoms referred to the great toe suggesting gout, and 2 a progressive polyarthritis, one a typical arthritis deformans, another only Heberden's nodes.

Following operation one of the women with vague discomforts was relieved of her symptoms; the others noted no change in their joint condition. Nine of the women over forty developed some sort of joint difficulty after the induced menopause. Four had the vague symptoms described above. Of these, one was cured in a few weeks by systematic exercises and another by a change of residence from England to America. The 2 others continue to have symptoms. A fifth woman began to have severe pains in all joints together with a low grade of fever. She also had a severe hypertension and a neurosis. Removal of one badly abscessed tooth and several less involved teeth gave no relief. Two women had typical Heberden's nodes beginning two and three years, respectively, after operation and have continued in the same condition. One woman suffered an attack of acute arthritis with fever which cleared up completely.

To summarize: Of the 41 women of forty or more years of age, one woman was relieved of joint symptoms coincident with operation, 9 acquired joint difficulties subsequent to the operation, of whom all recovered except 5 who still continue to suffer from three different types of joint difficulty.

Of 19 women under forty years of age, 15 have never had joint manifestations, one suffered from indefinite pains in the arms and legs for several years prior to the operation and was relieved by it. Two women after the operation had attacks of acute joint symptoms with fever and recovered completely. One woman aged thirty-nine suffered from stiff fingers and knees and puffy hands which cleared up completely after three months of strenuous exercise. Another with pains in the wrists occurring one year after operation was relieved by tonsillectomy.

In none of the women under forty years of age have any symptoms or signs persisted.

To summarize the findings in the 60 cases: Five women all over forty years of age developed symptoms referable to the joints and have continued to suffer, indicating a possible degenerative process. The clinical pictures, however, are of three fairly distinct types. In none of the women under forty have there been any persistent joint symptoms.

From this evidence it would appear that the abrupt termination of menstruation by radiotherapy has not been an important factor in the causation of arthritic changes. While there have been some joint manifestations following the induction of the artificial menopause, these have, for the most part, been temporary, and those which have persisted have been of such varied character that they do not impress one as having a common origin.

Lacking any outstanding facts which would link joint changes with the radiotherapeutic menopause one is stimulated to speculate concerning any possible relationship between the two. Two physiological effects may have a bearing, the vasomotor disturbances so commonly seen, and possibly a change in the calcium metabolism. The well-known and little-understood hot flash may be one manifestation of a generally disturbed vasomotor control which may cause alterations in the deep capillaries as it does in the skin. As Pemberton[2] has pointed out, the disturbances of the flow of blood in the joints may be an important factor in the etiology of arthritis. The other effect is more difficult to establish. Sharlit, Corscaden and Lyle[3] have shown a slight change in the blood calcium during menstruation; and in current experiments there is some evidence that there is a change after castration. All of these considerations appear to be founded on scanty evidence so that we must for the present rely on empiricism.

From the practical standpoint one must

regard the relationship between the therapeutic menopause and arthritis as unimportant and must ignore it in deciding upon the merits and demerits of the procedure; and in the management of joint conditions one should minimize efforts directed toward replacing deficient ovarian substance and concentrate upon the more conventional methods.*

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COMPLICATIONS FOLLOWING THE APPLICATION OF RADIUM TO PELVIC LESIONS†

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EVERY potent drug or therapeutic agent possesses deleterious as well as curative properties; therefore it is important that the indications and contraindications for the use of such drug or therapeutic agent be understood, and the signs and symptoms of untoward effects be recognized.

An agent which is capable of destroying living cells and of affecting tissue metabolism as does radium must of necessity be used with considerable caution, and the patient must be kept under close observation during and following treatment. The erythema dose has been fairly accurately determined, and more or less standard methods of protection to the surface exposed are now employed. The systemic reaction following the use of radium is considered due to acidosis, and varies in each case depending largely on the size of the growth and on the amount of necrosis.

The reaction consisting of slight malaise, nausea, sometimes with vomiting, and slight diarrhea which occasionally occurs immediately after the use of radium and lasts for from twenty-four to thirty-six hours is so common and so transient that it is considered normal and does not require consideration here. However, if a large dosage of radium is used on an extensive malignant growth the symptoms may be so persistent and so marked that they become more or less serious, particularly if the patient is cachectic and anemic. Ullmann finds in cases of inoperable carcinoma of the uterus that slight acidosis may be present before treatment is instituted, or if it is not present before treatment it may appear immediately or soon afterward, particularly if the tumor is regressing. In cases in which the tumor is regressing the metabolism of meat protein is necessarily forced, and during the destruction of the tumor an increased effort is required to maintain the alkalinity of the blood. Many of these patients suffer not only from the acidosis due to irradiation but from starvation acidosis. On the basis of the work of Blatherwick, Sansum and others on acidosis, Ullmann[1] suggests the use of the basic diet for patients treated by irradiation for extensive malignant growths.

The foregoing complications, together with pelvic cellulitis and peritonitis, are the most common following the use of radium in cases of carcinoma of the cervix; hemorrhage is an infrequent complication. If one considers that patients with extensive carcinoma of the cervix have little general resistance, that the field of treatment is an infected area which cannot be rendered sterile, and that the

[1] Ullmann, H. J. The management of the inoperable cancer patient. *Radiology*, 1924, iii, 497–501.

* For discussion of this paper see page 327.

† Read at the Twelfth Annual Meeting, American Radium Society, Washington, D. C., May 16–17, 1927.

circulation of the pelvic structures is interfered with, one will not be surprised at the frequency with which pelvic cellulitis and peritonitis occur.

Patients of the third and fourth groups (according to Schmitz' classification) usually require special preliminary care before receiving radium treatment. If the patient is particularly anemic, especially if because of recent hemorrhage, transfusion is indicated, rest in bed with forced feeding, forced fluids and slow, hot douches for a few days before the course of radium is begun increase the patient's resistance, and toxic symptoms and infection are less likely to occur.

It has been my experience that patients of the fourth group manifest less untoward reaction and withstand the full course of radium better if the first two treatments of the series are light, and several days apart. If the field is at least superficially sterilized, infection is less likely to occur and there will be less extensive necrosis of tissue. If fever develops at any time during the course of treatment it is of course discontinued and not resumed until the temperature becomes normal and remains so for several days. In some instances it may be advisable to discontinue the treatment before the course is completed and allow the patient to go home for six or eight weeks and then return to complete the course. The bleeding and the foul discharge usually cease after the second or third treatment, and the improvement in the patient's general condition and in the local lesion is often surprising in six or eight weeks following the use of a small amount of radium. The patient at the second visit may then complete the course without further untoward reaction. The patients having a toxic reaction usually respond promptly to supportive measures, such as rest in bed, absolute quiet, and physiologic solution of sodium chloride and glucose given by proctoclysis, if vomiting is persistent, and later the basic diet previously referred to.

Cases of cellulitis and peritonitis are treated as any other case of peritonitis by absolute rest in bed in Fowler's position, proctoclysis as long as vomiting and abdominal rigidity persist, and glucose solution intravenously if it is necessary to keep the fluid intake up to at least 1,800 c.c., or if toxemia is marked. Too frequent pelvic examination should be avoided but gentle bimanual examination should be made occasionally to detect early the presence of accumulation of pus in the cul-de-sac so that the pelvis may be drained. A definite pelvic abscess which can be drained through the vagina seldom develops, however. These patients convalesce slowly, often continuing to have fever for from six to eight weeks; supportive treatment is necessary throughout the illness. Culture of the blood seldom shows positive results and it is not so much the severity of the infection as the lowered resistance of the patient which delays the convalescence. If death occurs it is usually due to general toxemia or terminal pneumonia.

All patients in the third and fourth groups should be examined with particular thoroughness, with special reference to the urinary tract. The possibility of hydronephrosis should be considered, and a phenosulphonephthalein test and estimation of the blood urea should be made. If there is a history of irritability of the bladder or hematuria cystoscopic examination should be carried out. Hertzer and Schreiner report 32 post-mortem examinations on women dying from carcinoma of the cervix. In 21 gross pathologic changes in the urinary tract, and in 17 stricture of one or both ureters with hydronephrosis were noted. They also report on a study of 50 cases of the third and fourth groups and state that in 50 per cent of the cases there was evidence of obstruction of the ureter with hydronephrosis or pyonephrosis which they believe due to metastasis or infiltration through the broad ligament and bladder. A ureter which may be only partially occluded before radium is used may become completely occluded afterward as a result of edema, and if the opposite kidney does not function adequately uremia occurs. Occasionally both ureters are affected and complete anuria may occur and the patient die from uremia.

If partial obstruction of one or both

ureters is diagnosed before radium treatment is instituted, it is advisable to give only palliative treatment, one or two short applications of radium in the vagina and after two or three weeks one or two deep roentgen-ray exposures, with the patient under observation. The treatment may be resumed later if complications do not arise following the first treatments.

In those cases of carcinoma of the cervix in which there is considerable narrowing of the lumen of the rectum or narrowing at the rectosigmoid juncture a full course of radium may produce sufficient edema to complete the obstruction. Such patients must be observed closely while undergoing treatment and for a period of two or three weeks subsequently, and if obstruction does occur a permanent stoma must be made in the colon.

Obstruction of ureters and rectum is, of course, much more common in cases of recurrence of pelvic malignancy, and in these cases, examination should be most thorough to rule out the presence of obstruction.

If the mucosa of the bladder is involved or edematous, the treatment of the carcinoma must be modified somewhat to avoid overexposure of the affected tissue to the radium and so to avoid the subsequent development of a vesicovaginal fistula. Vesicovaginal and rectovaginal fistulas have become rare complications following radium treatment during the last few years as the result of improved technique in the use of the radium.

The association of carcinoma of the uterus or cervix with exophthalmic goiter or hyperthyroidism presents a difficult problem. One hesitates to delay the treatment of the malignant disease during the management of the hyperthyroidism entailing, as it does, preparations for operation, and the convalescence. Two such cases occurred in the Mayo Clinic during the year 1926. One patient had had partial thyroidectomy twelve years before for exophthalmic goiter and when examined at the Clinic the recent loss in weight, the weakness and pulse rate of 120 were considered due to the extensive carcinoma of the cervix involving the broad ligaments. A diagnosis of probable recurring exophthalmic goiter was considered and the patient was given iodine (Lugol's solution). The basal metabolic rate was +27. The patient was considered in satisfactory condition and the radium treatment was instituted. After the second application of radium, fever of 103° developed with rapid pulse and evidence of acute hyperthyroidism. The patient died five days after the second treatment. Necropsy disclosed metastasis to the peritoneum, liver, and lungs, and hyperplasia of the thyroid. It is a question, in view of the extensive involvement, how much the exophthalmic goiter was responsible for the final result. The other patient had a basal metabolic rate of +36, and partial thyroidectomy was performed. Fourteen days later radium treatment was instituted; unusual reaction did not occur.

The patients receiving radium treatment for benign pelvic lesions seldom experience serious toxic symptoms. They may be slightly nauseated during the time the radium is in place, and slight malaise may be present for a few days to three weeks following the treatment. Pelvic cellulitis or the lighting up of quiescent salpingitis are the most common complications in the benign group. Symptoms develop usually within three or four days following irradiation and may persist for from a few days to several weeks, depending on the severity of the infection. The history of previous pelvic infection, even though it occurred several years earlier, or evidence of cellulitis or chronic salpingitis is a definite contraindication to the use of radium. Such patients should be transferred to the surgeon or to the roentgenologist for treatment. The same treatment is carried out in the benign case in which peritonitis develops as is carried out in the malignant case.

The sequelae of irradiation for carcinoma of the cervix consist of trophic ulcers of the rectum and bladder and stenosis of the cervical canal with pyometritis. The ulcers may develop soon or many months after irradiation and often persist for many months. When they occur in the rectum there is usually bleeding and in some cases rectal pain and tenesmus. If the rectum is kept clean

by the use of hot water and hot oil enemas the ulcer tends to heal. When the mucosa of the bladder is affected the symptoms are those of cystitis. Sometimes the differential diagnosis of trophic ulcer and extension of the malignant lesion to the bladder is difficult. A specimen may sometimes be obtained for microscopic diagnosis. Lavage of the bladder and subsequent observation determine the diagnosis. A patient with unusually late vesical symptoms was examined in the Mayo Clinic in September, 1926, four years after receiving 1300 mg-hr. of radium for carcinoma of the cervix. At the time of treatment she was thirty years of age and had an epithelioma of the cervix, graded 4. Symptoms of cystitis had developed in July previous to her examination in September. On pelvic examination only a slight thickening in the region of the right broad ligament was noted; the cervical mucosa was normal. A catheterized specimen of urine contained considerable pus, and cystoscopic examination disclosed bullous edema of the base of the bladder with two areas of leathery consistency covered with phosphatic deposit. The whole area bled easily and both meatuses were involved with a suggestion of obstruction of the right. Several specimens were removed for microscopic examination; these were reported inflammatory. There was slight improvement following lavage of the bladder and the symptoms of vesical irritability subsided. The patient's physician reported recently that improvement in symptoms and general health has continued. In cases of stenosis of the cervical canal, fever and pelvic pain develop, and examination reveals an enlarged and tender uterus. Dilatation of the cervix and irrigation of the uterine canal usually clear up the infection.

During the year of 1926 at the Mayo Clinic, 134 cases of inoperable carcinoma of the cervix were treated with radium. In 24 (17.9 per cent) of these, complications developed during or immediately following the course of irradiation. This number includes one case of pneumonia which developed immediately after the first application of radium; there were no symptoms of pelvic complications. In 10 cases the symptoms were of short duration and the evidence of pelvic infection was so slight that the applications of radium were resumed after a few days; in 7 it was necessary to discontinue treatment either because of the general poor condition of the patient or because of complications. In one case of profuse bleeding from carcinoma of the cervix in which three applications of radium did not control the hemorrhage, treatment was discontinued for six weeks; the course was then completed without difficulty. In 3 cases the signs and symptoms of pelvic cellulitis occurred a few days after the series of treatments had been completed. In 9 of the 23 cases in which there were pelvic complications intra-uterine applications of radium were made. Phlebitis occurred in one case and cystitis in three.

In 23 cases of carcinoma of the fundus in which intra-uterine radium treatment was given, fever and phlebitis developed in only one; treatment was abandoned after the second application in this case.

Two hundred twenty-seven patients were treated during the year for menorrhagia associated with a fibrous type of uterus or with uterine myoma, and complications occurred in 5 instances (2.2 per cent). In 2 cases the symptoms occurred late; in one there was continued bleeding and pelvic pain for which abdominal hysterectomy was performed six weeks after the treatment; in one pelvic abscess developed six weeks after treatment and was drained. In one case hemorrhage occurred nine days after treatment, and in 2 evidence of pelvic cellulitis, the fever and abdominal pain occurring forty-eight hours after the insertion of radium; this subsided in three days in one instance, and in one in which the complication occurred twenty-four hours after treatment, the symptoms persisted for three weeks. The patient finally recovered completely.

CONCLUSIONS

1. In cases of carcinoma of the cervix a thorough physical examination is imperative; this should include a cystoscopic examination when bladder irritation exists, before radium treatment is instituted.

2. Great improvement often follows the use of a few short periods of irradiation at intervals of several days in cases of extensive malignancy in toxic patients.

3. When evidence of pelvic infection occurs treatment should be discontinued until all signs and symptoms of infection have subsided; it should be abandoned if the patient's condition is not good.

4. Tissue reaction with slow healing at times difficult to differentiate from extension of malignancy, may occur in the vesical and rectal mucosa producing local symptoms many months after the use of radium.

DISCUSSION ON PAPERS OF DRS. CORSCADEN AND STACY

DR. OSCAR L. NORSWORTHY, Houston, Texas. Several of the complications mentioned by Dr. Stacy have been encountered at our clinics; some followed our own application of radium and others occurred after applications made elsewhere.

Pelvic infection can be prevented in nonmalignant cases but in many malignant cases one finds infection already of the cervix or perimetrium. Thorough aseptic surgical technique is the only method of prevention. Early evacuation, under local anesthesia, is essential when it is possible to locate the pus. Severe systemic reaction is unavoidable in anemic and in septic cases and where there is lowered resistance from any cause. Large doses of radium should be avoided in such instances. A systemic reaction which occurs more than seventy-two hours after radium application suggests a careful search for pus.

Early irritation and later ulceration of the bladder or rectum, vesicovaginal and rectovaginal fistulas, can be prevented in nonmalignant cases but not in many late malignancies. The question of an indwelling catheter in either the bladder or the rectum must be solved in the individual cases. Ureteral obstruction is unavoidable in cases of extension of the infiltration to the broad ligament. Many are obstructed before the application of radium. Hemorrhage at first menstrual, following radium application occurs occasionally. This we have attributed to the application being made just before a menstrual period, to posterior misplacement, or other pelvic pathology.

Stenosis, with or without pyometritis, is often the result of a radium applicator remaining too long in the internal os. The applicator should be held in the cervical canal external to the internal os in cases in which there is no atrophy of the uterus.

Our cases of pyometritis have occurred in the retroplaced uteri which failed to drain. We always follow our cases of posterior misplacement of the uterus for several months after radium application.

Lighting up of quiescent salpingitis and cellulitis is a dangerous complication and can be prevented only by a carefully elicited previous history, and by being careful of the dosage in doubtful cases. The application of radium within the uterus without a careful diagnosis is a hazardous practice and should be condemned. We are careful to have deliberate answers to the four following questions before deciding about previous pelvic infections:

A. Did you ever have septic poisoning or blood poisoning?

B. Did you ever have child-bed fever?

C. Did you ever have an attack of pain in the abdomen, followed by hardness or swelling of the abdomen?

D. Did you ever have fever and chills coincident with soreness in the lower abdomen?

A condition which occasionally arises, but which was not mentioned by Dr. Stacy, is that of delayed extreme pain to touch in and around the cervical remains. This is apparently a neuritis or neuralgia of that particular field which is atrophied from the radium rays. We have found nothing but time to be of benefit in these cases, nor have we found a cause for it other than extreme fibrosis.

The location and character of the infiltration, whether hard or soft, whether there is a crater formation or a cauliflower growth; the screening, dosage, location of radium and length of time used; packing of vagina and keeping the bladder and rectum empty, are all factors of importance in preventing early and late complications following the application of radium in the female pelvis.

The menopause syndrome is not a true complication and depends chiefly upon the nervous equilibrium of the individual. While age is to be considered it has but little bearing, only to the extent of ovarian destruction.

Dr. Corscaden's conclusions, which were arrived at after a careful study of a large number of cases observed over a period of several years, are convincing that the nervous equilibrium of the individual is the principal factor in a large majority of the complaints developing at the menopause. While Cecil concluded that there is a definite arthritis, which probably results from loss of ovarian hormone, an unbalanced nervous equilibrium of congenital origin, or acquired through

excesses of life, or unhappy domestic relations, is present in the large majority of cases.

In practically all types of arthritis there is a chronic autointoxication, though not necessarily a disturbed metabolism. In arthritis associated with the menopause, endocrine imbalance may be in part responsible for the varied nervous manifestations coincident with the menopause. The major cause, however, is more likely psychosis in general, heredity, pre-existing nervous abnormalities, intoxicants and living environment.

Dr. Curtis F. Burnam, Baltimore, Md. I thought that arthritis following irradiation was due to intrauterine ulceration or that perhaps a chronic focus of infection in the endometrium similar to that which occurs in the tonsil developed and that the arthritis was due to this. On reviewing our cases, it developed that arthritis was quite as commonly found in patients who had had abdominal and other external irradiation as it was in those who had had intrauterine irradiation. I am inclined to believe that these patients had reached the arthritic age when chronic infected tonsils and bad teeth are common.

One should be particularly careful in treating cancer of the cervix if the disease is intracervical. If it is necessary to put tubes into the uterine cavity or up to the internal os and give heavy irradiation there, one should be extremely careful in the selection of cases. On the other hand, we have had few bad inflammatory complications where the applications have been more superficial. Many of our inoperable cervix cancers occur in dispensary patients who are not given rest in bed at all, but come into the clinic and are treated usually in the knee-chest posture. Our plan is to give 2 to 3 gram hours at the first application and to watch them afterwards. However, what Dr. Stacy has said should be given great consideration. We will observe fewer complications if the cases are carefully studied before hand. The study of the bladder is very important. Cystoscopic and proctoscopic examinations should be made before treatment is undertaken, and then rest and general upbuilding will make it easier for the patient and perhaps save lives and bring about cures that would otherwise not be obtainable.

Dr. William P. Healy, New York City. Dr. Corscaden's remarks impress me because I have seen and continue to see many patients who complain of symptoms referable to the joints of the extremities. Practically all of them finally get rid of their symptoms without any remaining joint conditions. To my mind the symptoms are essentially only toxic, resulting from some interference with the metabolic activities of the patient.

I practically never see these symptoms in carcinoma of the cervix cases in which we use heavy doses of radium plus roentgen radiation externally. We rarely see them in myopathic uterine bleeding in which we use small doses of radium. It has been my impression that these symptoms are most marked in cases of fibromata of the uterus in which we use the intermediate dosage. I think it is not the dosage so much as the fibroma. I believe there is something in the tissues of the fibroid tumor, the activity of which has been terminated by an intrauterine application of radium up to 1400 to 2000 mg-hr., and that there is something of a toxic nature that for a time creates the joint symptoms. The only treatment I have attempted in any of these cases has been elimination.

I believe with Dr. Burnam that septic peritonitis and cellulitis should be very rare in the treatment of cases of carcinoma of the cervix or corpus. I believe that it is wiser in the advanced cases, with evidence of pelvic cellulitis or pelvic inflammation, to ignore the carcinoma for the time being and clear up the sepsis if possible before attempting irradiation, and I have referred such patients to the roentgen-ray department for treatment. In some instances the patient has done so well that it has been feasible to follow this up with radium later.

Dr. Henry Schmitz, Chicago. We have made observations similar to those of Dr. Stacy and feel that the complications increase in the clinical groups 3 and 4, particularly the latter. The early complications as fistulas of the bladder and rectum can be almost entirely eliminated by careful endoscopic examinations of the bladder and rectum prior to irradiation. If there is bullous edema of the bladder mucosa we should defer the application of radium. Bullous edema usually means extension of the carcinoma to the bladder wall. In such cases treatment with the roentgen-ray alone is given. Should the patient react very markedly to the roentgen radiation then radium insertions are added. Presupposition is that the bladder mucosa has again assumed a normal state. If the mucosa does not return to normal then we deem the case hopeless. By such careful selection of cases fecal and urinary fistulae can be avoided. Of course, eventually the cancer will cause such fistulae in about 15 per cent of all cases. The latent complications have been ably described. We have found that stenosis of the cervical canal with pyometra and infections of the urinary tract are the most

common. Pyometritis is ushered in by deep pain in the pelvis. If an examination with a sound is made we find pus. Careful dilatation and the insertion of a rubber T drain are helpful. We do not advise irrigation but leave the drain in for two or four weeks when local healing has progressed and a reformation of the stenosis is unlikely. The urinary complications are the most serious. Careful examinations and correct diagnosis must be made. Usually in 15 per cent of cervical carcinomata death is caused by complications of the urinary tract. It is really one of the most frequent complications of cervical carcinomata. Hence the question always arises whether fistulas result from radiation or from the disease. However, infections of the kidneys can be relieved by indwelling catheters, careful dilatation of the ureter and by renal pelvic lavage.

Recently we saw a very latent complication in a patient who had been treated in 1917 for a group 3 carcinoma of the cervix. She received at that time 4000 mg-el-hr. of radium, inserted into the canal, and also external roentgen-ray treatment. Even today we still can see the fields very plainly on account of a persistent browning of the skin, so the dose given at that time was certainly a full dose. Nine years later she noticed painful urination and hematuria. On examination we found an incrustation which was firmly imbedded in the posterior bladder wall. This was carefully removed by the curette. Microscopic examination showed benign tissue. Irrigation and alkaline medication alternating with acid medication have caused great relief. The tolerance of the bladder has remained poor.

Dr. Henry J. Ullmann, Santa Barbara, Calif. The minor complications, I believe, can be obviated to a great extent. The radium reaction can be reduced to a negligible amount if one starts the proper diet two days before irradiation is attempted and brings the pH up to 7. One may have to add soda to accomplish this.

We have had little or no inflammation of the bladder or rectum. We push the vaginal walls well away from the cervix with the packing. We have not as yet had to catheterize a bladder and we believe it is due to our sliding a finger into the vagina above the packing and drawing the urethra forward, as the final procedure. I have seen the urethra come forward half an inch.

I would suggest that ultraviolet radiation be tried on ulcers that can be reached with an applicator. I think you will be surprised at the results.

Dr. Archie L. Dean, Jr., New York City. From the standpoint of the urologist, I should like to discuss the bladder ulceration which Dr. Stacy has brought to our attention. During the last one and one-half years 3 women have come to me complaining of hematuria, dysuria, and polyuria of considerable severity. The symptoms began suddenly. The only factor of importance in the past history was the radium treatment which each had received for carcinoma of the uterus. In 2 cases the tumor was of the cervix, in the other the corpus was involved. The irradiation had been received more than fourteen months previously in each case. By vagina there was no induration of the bladder. Cystoscopic examination revealed in each instance a solitary ulcer of the bladder base. These varied in size between 0.5 and 2 cm. The involved areas were covered with slough impregnated with phosphatic deposit. Surrounding the ulcers there was considerable edematous inflammation. From the cystoscopic appearance it was impossible to determine whether or not we were dealing with a carcinoma, therefore biopsies were performed. The histologic diagnosis was inflammation with no evidence of tumor formation. It is of importance that these ulcers be recognized by the cystoscopist because they are occurring with greater frequency. Probably they are due to an obliterative endarteritis resulting from the previous irradiation. On this account, if we mistake them for cancers and apply the usual destructive agents, for treating this disease, the result probably would be a vesicovaginal fistula. We treat these patients with an alkaline hyoscyamus mixture by mouth in conjunction with instillations of gradually increasing strengths of mercurochrome 220 solutions.

Dr. Corscaden (closing). We have had four severe pelvic infections following pelvic irradiation. We studied them closely to determine whether this was a lighting up of a chronic salpingitis or whether it depended on the irradiation. Two of them started with swelling in the broad ligaments and one ruptured into the rectum. In none was there what we would call an abscess in the peritoneal cavity. It was our feeling that the cases were straight surgical infections predisposed by the lowered resistance of the endometrial tissues. I think any one who has done much surgery will feel satisfied if he has less than 1 per cent of infection.

Those of you who have done any amount of gynecology will remember that several years ago one of the treatments for chronic cervicitis was the introduction of a solid stick of silver nitrate into the cervix. This produced a

splendid effect upon the discharge, but was followed in many instances by pyometra due to the stenosis of the cervix. In the application of radium I think one must either promise an open cervical canal following application, or destroy the lining of the uterine cavity. If he believes in this, he will insert his first dose of radium well up in the uterine cavity in order to be sure of destroying all of the tissue in the uterus. The subsequent applications can be made to the end of the canal. I believe the endometrium acts as a foreign body and if it is allowed to remain we are bound to have a pyometra.

RADIUM IN THE TREATMENT OF CANCER OF THE CERVIX UTERI

A REVIEW OF A PREVIOUS TREATISE WITH ADDITIONAL FOLLOW-UP STATISTICS

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ON April, 1926, the author[1] reported at the annual meeting of the American Medical Association in Dallas, Texas, a study of 232 cases of carcinoma of the cervix uteri treated with radium during the years 1921–22. Recently these cases have been re-studied with the object of bringing them to the five-year period since the first treatment. Some were treated a little less than five years ago, as they came to the hospital late in 1922, and others are in their sixth year. The former article is herein reviewed and the new statistics added.

SUMMARY OF PREVIOUS STATISTICAL STUDIES

Statistics of various reports on carcinoma of the cervix used for comparison:

At Johns Hopkins Hospital, 1913, only 57 per cent of the cases entering up to that date were operable; 11 per cent of these died from complications after the operation, and only 25 per cent were cured, that is, 8 per cent of the total number.

Martzloff[2] found a lower percentage of operability—46.5 per cent. The total operative mortality in his series of 387 patients operated on prior to 1920 was 14.2 per cent. At the time of publication there were living and well 26.6 per cent past the five-year period.

Clark and Block[3] reported that in 33 per cent of the operable cases past the five-year period, the patients were well. In 22 of their operable cases in which radium was used, 27.2 per cent of the patients passed the quinquennial mark; 6.7 per cent of those with inoperable cancer remained well for five years. In the total of 144 cases of which 15 per cent were operable, 10.4 per cent of the patients remained well five years. When one adds 5 and 10 per cent surgical mortality to the 27.2 per cent cures, it is clearly seen how well radium therapy compares with operation. Adding the large number of the hopeless inoperable group who are greatly improved by radium, together with a 6.7 per cent cure in this distressing class, the great value of this physical adjunct to the surgeon's armamentarium may be seen.

Greenough[4] reported a study of 829 cases of cancer of the cervix. Of these, 84 patients were free from disease three or more years after treatment, more than half of which "cures" were obtained by the use of radium and the roentgen ray without radical operation. In 243 cases included in the early favorable or borderline groups hysterectomy alone cured one in three, with an operative mortality of

one in five. He concludes that in early and favorable cases of cancer of the cervix the choice between operation and radium is an open one.

Series in the Howard A. Kelly Hospital. In 1915 Kelly and Burnam[5] reported a series of 213 cases of cervical cancer. Of the 14 operable cases, in 10 the treatment was by operation and in 4 with radium alone. All of these patients were living and well at the time the report was published, from six months to three years after the beginning of treatment.

In the 199 inoperable and inoperable recurrent cases, 53 patients (27 per cent) were clinically cured; 109 (54 per cent) markedly improved, and 37 (20 per cent) not improved; 35 of the originally inoperable cases remained well as follows:

TABLE I

No. Well	4 Yrs.	3 Yrs.	2 Yrs.	1 Yr.	6 Mos.
35	2	2	4	17	10

In 18 originally recurrent cases the results are shown in Table II, the authors employing the term "clinically cured" and reserving the term "cured" for later studies.

TABLE II

No. Well	6 Yrs.	4 Yrs.	2 Yrs.	1 Yr.	6 Mos.
18	1	1	1	10	5

In November, 1922, after a lapse of seven years, Burnam[6] made another study of the same cases. At this time it was learned that a 50 per cent cure had been effected in the operable class, the cure of the oldest patient extending over a period of eleven years. Of the inoperable cases, in which 27 per cent of the patients were clinically cured, only 15, or 6 per cent, remained in the cured class, as 42 had been treated only in the last eighteen months.

A year later Burnam and Primrose made a study, which has not been published, of all patients with cancer of the cervix (429) treated up to January 1, 1918. This gave the shortest period after treatment of four and one-half years. Their results are given in Table III.

Fricke[7] recently reviewed all the cervical cancers treated with radium and roentgen rays. We have been using the roentgen ray for the last three or four years to replace outside irradiation in selected cases, so that the series, although interesting, is too recent to permit of definite conclusions.

TABLE III

DATA OF BURNAM AND PRIMROSE'S PATIENTS WITH CERVICAL CANCER

Operable Cases

	No.	Well	Died of Other Causes	Died of Recurrence	Under Irradiated	Over Irradiated	Lost	Failure	Per Cent
Cured	18	10	7	1 (5 yrs.)	..	..	..	..	72
Not Cured	7	..	1	.....	1	1	1	3	28
Total	25								

Postoperative (Prophylactic Irradiation)

	No.	Living and Well	Recurrent 5 Yrs.	Died Within 5 Yrs.	Died of Recurrence	Lost	Per Cent
Cures	8	7	1	..	..	..	57
Failures	6	..	..	3	3	..	43
Total	14						

TOTAL NUMBER TREATED AND NUMBER AND PERCENTAGES OF CURES EFFECTED TO 1918 AFTER 4½ YEARS HAD ELAPSED

	No. of Cases	No. of Cures	Per Cent Cured	Total Per Cent Cured
Operable	25	18	72	
Prophylactic irradiation	14	8	57	
Inoperable	224	19	8.8	
Recurrent inoperable	166	21	13	
Total number	429	66		15.3

TABLE IV

RECENT CASES OF CERVICAL CANCER AT THE HOWARD A. KELLY HOSPITAL

	Radium and Roentgen Rays
Primary cases	44
Recurrent cases	10
Operations and roentgen rays	1
Total	55

	Number	Percentages
Not helped	12	22
Slight palliation	14	25
Marked improvement	17	31
Not followed	1	2
Clinical cures	11 (4 yr. +)	20

Apparently, from Table IV, one would think that the clinical cures are rather low, namely, 20 per cent. When looking over the summary of the cases, one finds it significant that only 5 of the 55 cases (10 per cent) were really operable, in one of which operation was done. Four were borderline and 35, or 63 per cent, were advanced and inoperable. Even with this exceedingly difficult group, 20 per cent of the patients were clinically cured, one remaining well more than four years.

PRESENT SERIES

The present series consists of 232 cases of cancer of the cervix uteri treated during 1921–22. These were chosen arbitrarily as examples of treatment with more recent, perfected technique.

TABLE V

SUMMARY OF 284 CASES (TREATED, 232) OCCURRING DURING 1921–22

Operable	14
Operation after radium	8
Recurrent	41
Prophylactic after operation	2
Borderline	19
Cautery and radium	–
Inoperable	126
Inoperable and well	15
Total treated	232
Deduct because of insufficient data	52
	284

In revising this series we find that a few patients have died since the last report, but in the majority the well group has been extended to the five-year period.

Explanation of Table VI. Clinically cured cases are those which were well when last seen at the hospital, or when last heard from, many of them having been examined by the doctors who referred them. In the first column under this heading are placed those who were well when last seen, but could not be traced through the five-year period. The second column includes those who were traced through the five-year period, with some of them slightly under five years on account of having come late in 1922, the summary being made in 1927. On the other hand, some run in the six-year period and over. The next two columns give the same data in percentages. The other columns of this table are identical to those in the former report.

Studies of Each Group. 1. Operable Group. Seven out of 14 cases are in the five-year period; one has a cystitis, one has pain in the hip without any evidence of growth and another has rectal bleeding but no evidence of growth. It will be noted here that there is a lower percentage of cures in this group than reported a year ago (57+ per cent). One case counted as well then had not been seen since eight months after treatment but is now known to be dead. Of those not cured, the patients lived from five months to two years and ten months after treatment.

2. Operated on after Radium. Fifty per cent were well when last seen and 25 per cent have passed the five-year period. One of these not cured died from post-operative hemorrhage.

TABLE VI
CASES TREATED WITH RADIUM

	No. of Cases	Clinically Cured		Per Cent Cured	Per Cent 5 Yrs.	Primary Growth		Per Cent Clinically Cured One Year Ago
		Under 5 Yrs. Lost	5 Yrs.			Improved Per Cent	Healed Per Cent	
Operable	14	..	7	50	50	29	14	57+
Operation after radium	8	2	2	50	25	25 (2)	....	50
Recurrent	41	3	6	22	14+	40	20	24.4
Prophylactic	2	1	1 (4 yrs.)	100	....	....	....	100
Borderline	19	1	2	16	10+	21	53	21+
Radium and cautery	7	1	2	43	28	14+	28+	43
Inoperable	141	7	6	9+	4+	44.4	28.3	10

3. Recurrent after Operation. Nine cases were well when last seen, 22 per cent (last year 24.4 per cent); 6 passed the five-year period, 14 per cent; 1 was lost after four years, 1 after a year and 1 after two months; 6 not cured lived from three months to two and one-half years after treatment. Another case recurred after five years.

4. Prophylactic after Operation. These 2 patients were lost after one year and three months, and four years, but were well when seen.

Combining groups 2 and 4 we have a total of 10 cases with operation plus radium, with a clinical cure of 6, or 60 per cent—2 after five years, 1 after four years; the others we were unable to trace.

5. Borderline Cases. Three out of 19 are well, 16 per cent; 2, or 10 per cent, after the five-year period. The remaining one had doubtful growth after four years, but no word has been heard since. In the report one year ago there were 4 in this group which were clinically well (21+ per cent), but one has had a recurrence after four and a half years.

6. Radium and Cautery. Some of these cases were inoperable and the cautery was used to check hemorrhage, but 3 of the 7, 43 per cent (unchanged since last year), were well when last heard from, 2 (28 per cent) remaining well five years and the third was lost after four months.

7. Inoperable Group. Of the 141 cases pronounced inoperable when seen we have been able to trace 6, or 4 per cent, past the five-year period. In other words, these 6 would have been dead had it not been for radium. In comparing these data with those of last year we find that only 2 were past the five-year period and 6 past the four-year period; now the statistics are reversed, i.e., 6 are past the five-year period; 2 of the 15 cases then reported as well have since died, reducing the number of cures to 13.

Table VII shows the results of the 13 cases which are inoperable on admission, but have been traced through the varying periods as represented:

TABLE VII

No. of Cases	1 Yr.	18 Mos.	2 Yrs.	3 Yrs.	4 Yrs.	5 Yrs.
13	1	2	1	1	1	7*

* 1 of the five-year cases has recently had doubtful growth.

SUMMARY

Comparing these statistics with those of one year ago we find that 50 per cent of the operable cases instead of 57 + per cent have passed the five-year period with no evidence of growth. This illustrates how important it is to trace statistics through five or more years. When one considers that there has been no primary mortality, one notes how radium therapy compares with operation. In the 141 inoperable cases, 9 per cent were clinically cured when last seen and 4 per cent have passed the five-year period as well—one of these had a small hemorrhage after the fifth year but the presence of disease is doubtful. What a remarkable advance in the therapy of this dreaded affliction!

How regrettable that 141 patients (60 + per cent) came in the later stages of the disease as evidenced by their being inoper-

able—this in spite of the untiring efforts put forth by way of cancer propaganda to have the patients come early. Let us hope that in the next five years greater strides will be made towards getting these patients to the doctor earlier when help may be more effective, and more lives saved.

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RADIUM TREATMENT OF TONSILS AND OTHER LYMPHOID TISSUE IN THE THROAT

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MEASUREMENTS made of the output of radium show that the beta rays are absorbed in fresh tonsillar tissue about 1.5 cm. thick, and are, therefore, especially adapted to the treatment of tonsils. But as these rays differ in their power of penetration, it is essential to choose among them and when treating a tonsil to exclude by a suitable filter the rays that act too near the surface and allow the remainder to pass that do not go beyond the tonsil but are absorbed within it, the small proportion of the very penetrating gamma rays passing on and out.

The number of patients that I have treated by this method, up to September 1, 1926, during a period of more than five and one-half years, is 431, their ages ranging from three and a half to seventy-eight years.† In the 137 consecutive cases here considered, a larger amount of radium element in the form of sulphate has been used, 55 mg., than in my previous cases and thus the time of treatment has been shortened.

Method of Applying the Salts of Radium. A pure gold container,‡ in which the radium lies in a thin and uniform layer, is held gently against the tonsil. This container is at the end of a rod to which an electric lamp giving a strong light is attached; its walls are so thick that the gamma rays only go through them and the quality of the beta rays that are absorbed within the tonsil, the gamma rays passing on and out, is controlled by a suitable filter and their spreading limited by an appropriate diaphragm, that is, one of 9 mm. in diameter and 5 mm. deep (Fig. 1).

Treatment. The treatments are painless, and as a rule in these cases were of six to nine or ten minutes' duration for each tonsil, and the filter of aluminum 0.6 mm. thick; in exceptional cases, however, a treatment of eleven or twelve minutes was found desirable; the filter then should usually be 0.7 mm. thick. The intervals between the treatments were generally three weeks, the average number being not quite four; for a few patients, who had very sensitive throats, a spray of a 2 per cent solution of cocaine was used.

† Since this date I have had one patient eighty-six years of age, who responded to the treatment as well as a person of thirty.

‡ This container, by the use of appropriate filters and diaphragms has a wide field of usefulness. It can be detached from the rod and used in other ways.

* Treatment of hypertrophied tonsils and adenoids by radium: a preliminary statement. *Boston M. & S. J.*, March 10, 1921, clxxxiv, 256–257. The treatment of tonsils by radiations from radium salts instead of operation; 101 cases. *Trans. Ass. Am. Phys.*, 1922, xxxvii, 204–210. Traitement de l'hypertrophie amygdalienne par la curie-therapie. *Paris méd.* 1923, xiii, 110–113. Prompt action of radium radiations in the treatment of small or large infected tonsils and lingual tonsils. *Boston M. & S. J.*, 1923, clxxxviii, 497. The use of radium radiations in the treatment of tonsils: a further report. *Am. J. M. Sc.*, 1924, clxviii, 18–34.

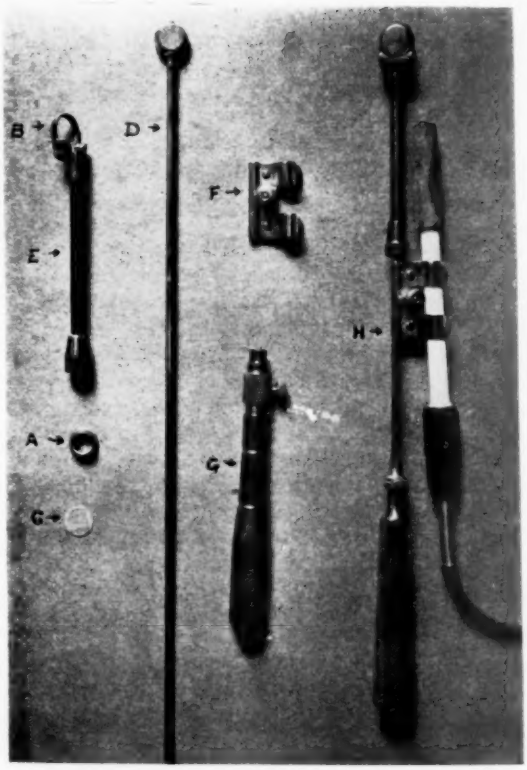

FIG. 1. The instrument on the right, total length 11 inches, has a container, at the upper end of a Monel metal rod, which is made of pure gold, with walls so thick (5 mm.) that the gamma rays only penetrate them. The upper end of this instrument when in use is covered by a thin rubber finger cot stretched over it, a new one for every treatment, which is held in place by small rubber bands. A glass tube that carries an electric lamp which gives a strong light, is held between double spring clamps and fastened to the Monel metal rod by another clamp by turning a round nut. The upper part of this glass tube is covered with a piece of sterilized red rubber tubing (black is too translucent), a new one for every patient, that shuts out all the light except at the end. To the lower end of this tube a hard rubber socket and a wire are attached for the electric current. A sterilized lamp, one of a number sterilized, is always ready for use.

The separate portions of this instrument, except the lamp, are shown on the left of the cut. To assemble the instrument, the circular diaphragm A is put into the ring B and into this is dropped the filter C. (Filters of any desired thickness may be used.) Then the Monel metal rod D, bearing the container, is slid through the tube E until the radium is brought directly above the filter and the diaphragm. The milled head at the lower end of the tube E is then turned and thus it is clamped to the rod D. Next the spring clamp F is slid over this rod and secured by means of a nut on its side, and then this rod is slid into the handle G and fastened by a setscrew. The container and the tube E are covered with a rubber cot (not shown in cut) and this cot is held in place by rubber bands. Then the lamp is pressed into the spring clamp F. Assembled instrument H. When the container is not in use a disc of gold 5 mm. thick is dropped into the diaphragm holder B, from which A has been removed, and then the rod D is slid into the tube E until the container is in place above the disc.

Rule for Making This Container. A disc of pure gold 14 mm. in diameter and 7 mm. thick is turned out on one side to a depth of 2 mm., leaving a rim 1 mm. thick and 2 mm. high. Then the central portion of the depression is deepened 0.5 mm. and widened to a diameter of 9 mm., thus making a space just sufficient to hold 55 mg. of radium element in the form of sulphate. This space is covered by a disc of mica 0.03 mm. thick, to protect the disc of aluminum, 0.29 mm. thick, placed above the mica, from the action of the radium. Over this a hollow steel cone is pressed down upon the gold rim, of such shape that the rim is squeezed inwards and over the edge of the aluminum. After the removal of the cone, by means of further pressure on a flat plate of steel placed above the gold rim, this is forced firmly against the disc and thus a strong tight joint is made. While the pressure is exerted upon the gold container it must be held in a piece of steel, which fits it exactly, otherwise the container will be put out of shape by the strong pressure upon it.

After the first treatment, especially, there was a discharge from the tonsils, of which the patients were as a rule unaware, that usually began from the eighth to the tenth day, and often this was profuse—good drainage is favored by this method as the action of the beta rays is stronger near the surface—and about this time, in a number of cases, there was some reaction in the tonsils, not sufficient, however, to interfere with the usual diet or occupation, but in a majority of the cases the patients have reported, at the end of the treatment, that they had had no discomfort in their throats at any time during its course. There was general and local improvement in the cases under consideration, and the former, which begins promptly, sometimes within a day or two, was often marked and patients expressed themselves emphatically about it. The tonsils may nearly disappear by this method of using radium, or, as is more often the case, may be greatly reduced in size.

The method is adaptable both as to the amount and the quality of the treatment given and this is desirable because the conditions to be met with in tonsils vary greatly; further, after seeing the results of the first treatment, the next can be better determined.

Submerged Tonsils. Submerged tonsils, when the history is suggestive, should be treated. Palpation with one forefinger outside, and under the tonsil, and the other in the mouth, may, of course, be helpful in

ascertaining the size and condition of such tonsils.

Fibrous Tonsils. If, on palpation, the tonsils are so firm as to indicate the presence of a considerable amount of fibrous tissue, they may still remain quite large even after the removal of the lymphoid tissue. This is of little consequence, however, unless the tonsil is in the way mechanically. The removal of such tonsils has seemed to me advisable in two instances only. In another case, for example, in which fibrous tissue of a considerable amount was left, there had not been any change in size after more than three years, but the patient during this time had been free from the colds and tonsillitis to which she had been subject before radium treatment was given, even when other members of the household had had such attacks. The aim is to get rid of the diseased lymphoid tissue.

The 3 following cases (as 20 cases were reported in a previous paper, this number seems sufficient here) illustrate the use of this method.

CASE REPORTS

F. S. W., aged twenty-two. History of frequent attacks of tonsillitis, diphtheria during the winter of 1923–1924, and later another attack of tonsillitis.

On February 4, 1925, when the patient came to me for radium treatment, he had acute tonsillitis, both tonsils were greatly enlarged, nearly meeting, and the gland at the angle of the right jaw was swollen. The right tonsil was given a treatment of eleven minutes, and the left one of ten minutes with 55 mg. of radium element, the filter of aluminum being 0.6 mm. thick. At the next visit, on February 12, the gland was no longer swollen; the crypts of both tonsils were open and discharging, there was no soreness in either tonsil, no congestion in the throat and the patient reported that he felt "first rate." No treatment was given. On February 25 the tonsils were much smaller, about on a level with the pillars, the crypts were open but there was no discharge; there was no congestion anywhere in the throat. A treatment of ten minutes, the second, was given to each tonsil, the same amount of radium and the same filter being used. On March 25 there was a slight discharge from the upper part of the right tonsil. A treatment of eleven minutes, the third, was given to this tonsil but none to the left, which was behind the pillars. As the patient was doing well, and lived at some distance from the city, I did not see him again; it seemed sufficient to put him under the observation of his own physician. On May 11, 1925, the latter reported to me that the tonsils were small and the man himself in good condition, and April 4, 1927, on inquiry, a good report was again received.

B. E., aged nineteen. History: Colds lasting several months; below par, very nervous and fragile, very easily tired; out of college because of ill health.

January 8, 1925, both tonsils were large, beyond pillars, left tonsil ragged; free discharge from the crypts. Two treatments were given to the right tonsil with 55 mg. of radium element, the filter used being of aluminum 0.6 mm. thick, of ten and eight minutes, on January 8 and February 2, respectively, and two to the left tonsil of ten minutes each on the same dates. Throat so sensitive that it was necessary to use a spray of a 2 per cent solution of cocaine at each of these treatments. February 25 both tonsils much smaller, but left larger than right, the latter being behind the pillars. Slight reaction in both tonsils the eighth and ninth days after the second treatment; no congestion in the throat. A treatment of seven minutes was given to the right and one of eight minutes to the left tonsil, the third, which was followed by a vigorous reaction, no cocaine spray being used. Patient looks and feels much better, color better and she has lost her "transparent" look. March 27, the patient has had no colds during the winter and for the last two days has run an automobile one hundred miles each day. Her improvement continues and "invalidism" is a thing of the past. April 24: Some of the left tonsil still remains; it is about on a level with the pillars, is somewhat firm and probably fibrous. November 10, 1925, the father of the patient reported that his daughter was in college and doing well, and in August, 1926, that she had had none of her usual prostrating colds since radium treatment was given, and finished her college year of 1925 to 1926 in excellent condition. April 4, 1927, on inquiry, a good report was again received.

The tonsils of the parents and of the sister of this patient were treated with radium with good results.

S. B., aged sixty. History: colds, arthritis in arm; attack of angina pectoris; infection in left ear. The physician of this patient would not consent to tonsillectomy on account of his heart.

On July 13, 1925, both tonsils were apparently small. Two treatments were given to the

right tonsil with 55 mg. of radium element, the filter used being of aluminum 0.6 mm. thick, of five and six minutes, on July 13 and August 3, respectively, and to the left tonsil of six and seven minutes, respectively, on the same dates. September 15, the patient felt better; the lower portion of the left tonsil was rough and discharging and was given a treatment of six minutes, the third. October 9, some firmness in the left tonsil; throat feels better; color better and arthritis in arm diminished; general condition much improved. December 29, the pharyngeal wall, which was rough and somewhat coated, was given a treatment of six minutes with 26 mg. of radium element. January 5, 1926, the patient reported that the pharyngitis was relieved. A treatment of eight minutes was given to the right tonsil with 55 mg. of radium element, the third; and one to the left tonsil of seven minutes, the fourth. January 15, pharynx slightly coated; it was given a second treatment of six minutes, with the same amount of radium element as on December 29. February 2, a slight discharge from the pharynx, which is much smoother and less congested. The throat has felt much better since the pharynx was treated. Tonsils clean and very small; arthritis in arm gone; cardiac trouble better and general condition markedly improved. When last heard from, about a year later, this improvement still remained.

It is important to realize that treatment of the pharynx as well as of the tonsils may be necessary.

Radium treatment of the tonsils is of great value, not only in promptly improving the condition of the patient in acute tonsillitis and shortening the attack, and in acute arthritis (relief in chronic cases is, of course, slower), but also in preventing or lessening the cardiac and renal complications that may accompany these diseases, and in getting rid of or preventing colds; it is valuable for singers and speakers; moreover, it can be given without interrupting the occupation.* There is perhaps no other small amount of tissue in the body that is the starting point of so much disability and serious disease and that, at the same time, is so amenable to treatment as is the lymphoid tissue in the throat. This tissue, being situated in a path which gives opportunity for the collection of a variety of microorganisms, provides a culture medium, together with warmth and moisture, which promotes their growth, as well as a point of distribution for these organisms and their toxins to various parts of the body. It is not surprising that the destruction of this tissue should be helpful in many ways.

Tonsillectomy Done after Treatment with Radium and before Its Completion. Of the total number of cases (431) treated by this method up to September 1, 1926, the following were operated on after treatment or before it was completed. The first case, quoted in a previous paper,* illustrates the importance of looking for another source of infection than the tonsils, if radium treatment does not have the desired effect.

"Miss Z. had recovered from an attack of arthritis, but had an acute attack of tonsillitis when I gave her radium treatment. After one application the tonsils were reduced to a very small size and she recovered from the tonsillitis. Four weeks later the patient had another attack of arthritis, a severe one, and tonsillectomy was done without my being consulted, the small size of the tonsils facilitating the operation. In less than three weeks after this operation she had another attack of arthritis which was followed by still another in about four weeks. An X-ray examination was made at this time which showed abscesses around two of the teeth. The teeth were removed and three months later, when last heard from, she had had no further attacks of arthritis."†

Another patient was not relieved either by moderate radium treatment or the subsequent tonsillectomy.

Two patients had large fibrous tonsils (this method does not get rid of this tissue) which were in the way mechanically and tonsillectomy was desirable and was done. The next patient for whom tonsillectomy had been advised on account of ringing in the ears, by which he was much disturbed, came to me for radium treatment, which I

* The case of a patient who was an auctioneer, illustrates this point. During radium treatment he was able to continue the strenuous use of his voice, three hours a day, that his occupation demanded, and on one occasion, almost at the end of the treatment, used it for three and three-quarters hours, a longer time than ever before, and yet felt that his voice was in fully as good condition at the end of the day's work as at its beginning.

* Williams, Francis H. Use of radium radiations in the treatment of tonsils, a further report. *Am. J. M. Sc.*, 1924, clxviii, 18–34.

† At this time (February, 1922) there was too little confidence in radium treatment for practitioners to look for another source than the tonsils, of arthritis, if this returned after radium treatment had been given. I did not see the patient after she recovered from the tonsillitis.

gave, telling him, however, that relief from its use was doubtful. As the ringing did not cease, tonsillectomy was performed, but this also failed to give relief. Another patient, whose tonsils had not wholly disappeared (but this is not necessary), had a sensation of something in the throat which caused him to swallow continually. I have not been able to learn whether or not tonsillectomy helped him. The last patient, who was of an extremely nervous temperament and was constantly watching his tonsils, which had not wholly disappeared under radium treatment, was helped by operation.

Of the 3 cases in which the treatment was not completed, one patient escaped her usual February attack of tonsillitis by radium treatment given the preceding January. This was followed by a second treatment in April. She was prevented by her work from keeping the further appointments given her. I did not see her again, but the following year she had an acute attack of tonsillitis and tonsillectomy was done. The other 2 cases were operated on during treatment without my being consulted, although in both instances favorable results of the treatment were already evident.

Radium Treatment of Tonsils after Tonsillectomy or Tonsillotomy Had Been Done. Thirty patients, who had had tonsillectomy and 7 who had had tonsillotomy done some months or years before, have come to me for radium treatment. In such cases a filter of aluminum 0.3, 0.5, or 0.6 mm. thick, according to the size of the tonsil, and a diaphragm also adapted to its size, should be used and a shorter treatment given, but experience is the guide in regard to the details of procedure.

Hay Fever. I asked two patients whose tonsils I had treated with radium, to report to me later concerning the hay fever to which they were subject, but only one has been heard from. This patient said that she had had no hay fever, whereas every year previously for a number of years, it had begun about August 20 and lasted until the first frost came. Her summer had been spent in the same place as formerly.

Prevalence of Diseased Tonsils. In order to suggest that the problem of treating the tonsils is a large one, the following figures taken from an earlier article are given. In 1921 the reports from only 24 of the hospitals in Boston and seven adjoining cities, population 1,180,000, showed that 13,325 tonsillectomies had been done in that year in those institutions. On the basis of these figures 514,240 ± tonsillectomies were performed in one year in cities of the United States of more than 10,000 inhabitants, population 46,750,000. The number of tonsillectomies would be still further increased if the towns of 10,000 inhabitants or less (population 70,000,000) were included, and there would be a still further increase if those not done in hospitals were added. A great amount of good has been accomplished by tonsillectomy, but this operation may have serious disadvantages as shown by the following table.

COMPARISON BETWEEN TREATMENT OF THE TONSILS WITH THE BETA RAYS FROM THE SALTS OF RADIUM AND TONSILLECTOMY

Tonsillectomy	Beta Rays from Radium Salts
Anesthetic	Anesthesia avoided
Operation	A few painless treatments
Shock	No shock
May remove other tissues than the tonsil	Removes only tissues it is desired to be rid of
Hemorrhage	No hemorrhage
Infection	No infection
Great soreness in throat	Avoided
Occupation interrupted	Occupation uninterrupted; an economic saving
Postoperative hemorrhage	No hemorrhage
Lung complications	No lung complications
Ear infection	No ear infection
May take a week or more for adults to recover fully from operation	Improvement in general condition sometimes begins within a day or two, and it continues
Operation inadvisable because of condition of patient	Can be used for patients who are not good operative risks
Most of the above, of course, seldom occur; in rare instances death may result	No deaths
Recurrences frequent.	Recurrences few.

Recurrence. Previous to September 1, 1926,—a period of more than five and one-half years—I have treated 431 cases of tonsils with the beta rays from the salts of radium, the container being held gently against the gland. Ninety of these were hospital cases and were not followed. The remaining 341 cases consisted of two groups, the first of which, made up of 204

cases, was treated prior to October 25, 1924, and did not have, as a rule, as much treatment as I now give. Seven of this group had a recurrence and further radium treatment was given. The second group of 137 cases, treated between October 25, 1924, and September 1, 1926, had more treatment than the first group and thus far there has been no recurrence.

Lane* reports that in only about one-half of more than 30,000 patients were the results permanent one to four years after operation. The number of cases I have treated with the beta rays is, I think, sufficient to indicate that a recurrence after this method is far less frequent than after tonsillectomy. Should one occur, more treatment is a simple matter.

Treatment of Tonsils through the Skin. If for some reason the tonsil is to be treated through the skin, in order to prevent a spreading of the rays, the usual short diaphragm is replaced by a tubular diaphragm of gold, about 15 mm. long, that has walls 1 mm. thick, an internal diameter of 8 mm., and a filter of aluminum 1 mm. thick at the end to be applied to the skin. This end, directed upward, is held by a handle for fifteen minutes under the tonsil of an adult and for about five minutes under that of a child. This method might be useful for treating the tonsils of patients who have scarlet fever. A disadvantage of treatment through the skin is that the drainage might not be so good as when the radium is applied directly to the tonsil, especially in cases that have previously had tonsillectomy done. The two methods can be combined by alternating the treatments, the first being given directly to the tonsil and the second through the skin.

The Use of Beta Rays for Treating Lymphoid Tissue in the Pharynx. In a previous paper I have referred to this use of radium. Here it can also render noteworthy service. Improvement in conditions in the pharynx, for example, is marked after this treatment, and a rough, discharging pharyngeal wall may become smooth and free from congestion. The radium is applied in a pure gold container smaller (8 mm. in diameter and 8 mm. long) than that used for the tonsils, holds 26 mg. of radium element, has a filter of aluminum 0.4 mm. thick, and is screwed onto a silver rod of such small diameter for about 3.5 cm. a little below where the two are joined, that this part of the rod can be bent in any desired direction. The container is held at a little distance from the portion of the pharyngeal walls to be treated, not only to avoid touching them, but also to allow the beta rays to spread and thus cover a larger area, and is moved about over these walls from six to eight to ten minutes, according to the extent of the diseased surface. These treatments, two or three are sufficient, (sometimes only one is necessary) are carried out under the same good illumination as that used for the tonsils, and the results are satisfactory, whereas the usual local applications are palliative rather than curative. Thus far there have been no recurrences. Some of my patients, whose tonsils were not infected, have obtained relief from arthritis, and showed general improvement after this use of radium on the pharynx.

For example, a patient whose tonsils I had treated three and one-half years before, returned, thinking she had a recurrence. On examination I found that the tonsils, what there was left of them, were not the cause of her condition, but that the pharynx needed treatment, which was given, and relief from arthritis followed. Another patient, who had been free from tonsillitis, arthritis and colds for more than three years after radium treatment of the tonsils, had a return of arthritis and a sore throat. Examination showed that the tonsils were pale, clean and free from congestion, but that the pharynx was red, rough and discharging, and the lateral pillars congested. After the second treatment of the pharynx with radium there was no arthritis nor stiffness nor pain of any sort, but as there was still some discharge from the pharynx, a third treatment was given.

SUMMARY

The radium is applied to the tonsil, for a few minutes, in the container, so designed that the beta rays can issue in the direction of this gland only; those that would

* Lane, Laura A. A study of the tonsil question, with a preliminary report of roentgen ray and radium therapy in pathologic tonsils. *Minnesota Med.*, 1923, vi, 97–104.

be harmful near the surface are excluded by an appropriate filter and the remainder are absorbed within the tonsil and act on the tissue it is desired to be rid of.

The dosage can be exact.

It is not necessary to eradicate the whole tonsil but all the diseased lymphoid tissue should be got rid of.

The method is safe and efficient and the recurrences few, whereas after tonsillectomy they are frequent.

Radium treatment is not subject to the complications that may accompany or follow operation.

The occupation is not interrupted: an economic saving.

Radium has a wider field of usefulness than that covered by tonsillectomy in that it can be employed for patients who are not good operative risks and, what is also important, for treating diseased lymphoid tissue in the pharynx and other parts of the throat.

When radium treatment is available, properly carried out, and its advantages better known, tonsillectomy, as a rule, should not be done.

THE FAILURE OF CHOLECYSTOGRAPHIC FILLING IN THE PRESENCE OF ACUTE PYLORIC PATHOLOGY*

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THE normal gall-bladder has failed to record its functional filling with sodium tetraiodophenolphthalein where there was active ulceration in the immediate prepyloric portion of the stomach in 6 of our cases. When the pathology at the pyloric portion of the stomach or in the duodenum is chronic, obstructive or healed, the normal gall-bladder offers the usual normal functional test. Only the oral method has been used.

Our attention was attracted to this phenomenon when we examined with an opaque meal, a patient who had been given an oral tetraiodo test by a distant colleague. This test seemed to establish a non-functionating gall-bladder. Our opaque meal established a ulcer of the first portion of the duodenum without obstruction. We did not repeat the gall-bladder test. At operation the gall-bladder was blue, contained tenacious bile and was somewhat flabby. The ulcer of the duodenum was active.

The second case recorded a definite pyloric obstruction and no gall-bladder shadows were obtained after the oral administration of tetraiodo capsules. Operation revealed extensive malignant ulceration of the lesser curvature in the immediate prepyloric area, and a normal gall-bladder.

The third case failed completely to show gall-bladder shadows. This was interpreted as a non-functioning gall-bladder and as this seemed to support the clinician's viewpoint, no further examination by opaque meal was pursued. The operation revealed a large active, perforating ulcer of the lesser curvature involving the pylorus, and a normal gall-bladder.

The fourth case showed no evidence of dye in the gall-bladder even upon a repeated examination, and the record of such non-function seemed established. The opaque meal established a duodenal deformity and pyloric obstruction. The operation revealed pyloric obstruction with a cicatricial duodenal bulb and normal gall-bladder.

These four cases offered evidence that seemed to support the hypothesis that the normal gall-bladder may fail to return the usual normal functional test after the oral administration of tetraiodophenolphthalein capsules in the presence of active ulceration at the pyloric portion of the stomach or first portion of the duodenum.

* Read at the Twenty-eighth Annual Meeting, American Roentgen Ray Society, Montreal, Canada, Sept. 20–23, 1927.

We have 30 cases recorded with satisfactory normal gall-bladder functional tests in the presence of chronic pyloric obstruction, massive malignancy of the stomach and chronic duodenal ulceration with varying degrees of gastric retention. The opaque meal established definite evidence of chronic, deforming pathology, while the gall-bladder tests were all normal. The operative records of these 30 cases are not complete but the findings in those who were operated upon supported the roentgen findings.

These cases seem to show that the presence or absence of pyloric obstruction has no relationship to the functional roentgen test by the oral capsule method. The presence of chronic deforming pathology upon either side of the pylorus *without peritoneal irritation* does not influence the roentgen gall-bladder test. But the presence of active pathology with peritoneal irritation or active penetrating lesions may interfere with the usual response of a normal gall-bladder to the tetraiodo oral capsule test.

The influence of the splanchnic nerves is offered as a possible explanation of these phenomena. Undoubtedly, when pyloric pathology has established itself and there is no peritoneal irritation, the gall-bladder function test is normal. But if the peritoneum is irritated or actively inflamed, the gall-bladder fails to offer normal responses to roentgen tests.*

CHOLECYSTOGRAPHIC STUDIES AFTER THE ADMINISTRATION OF SOME OF THE POPULAR CHOLAGOGUES†

BY WILLIAM H. STEWART, M.D., AND ERIC J. RYAN, M.D.

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A CHOLAGOGUE has been described as an agent which promotes the flow of bile or has the property of increasing the evacuation of this secretion. We believe it is generally thought that such drugs not only increase the secretory activity of the liver but at the same time cause an increase in the flow of bile by an actual emptying of the gall-bladder. Chance observations made during the cholecystographic examination of a series of clinical cases following the administration of many of the popular cholagogues seemed to disprove this effect on the gall-bladder—so much so that the authors felt the need of a careful investigation to ascertain the facts. Sosman, Whitaker and Edson[1] mention the effects of certain drugs and foods on the emptying of the gall-bladder as seen in the cholecystograms, but they did not pay any special attention to cholagogues.

The early cholecystographic observations of Boyden[2] as to the emptying effect of food, especially fats, on the gall-bladder are now generally accepted so that we may take food as a standard in the study of the effects of cholagogues.

Up to the present time 14 drugs have been tried. The procedure consists in the administration of the sodium salt of tetraiodophenolphthalein by mouth as described elsewhere.[3,4] The gall-bladder shadow obtained sixteen hours after administration of the dye was used for comparison, for at this time maximum concentration has been reached. The drugs were given after this sixteen-hour observation and frequent examinations were made from one-half to eight hours following, starvation being continued. Note was made of any change in the size, shape and density of the gall-bladder.

* For discussion of this paper see page 343.

† Read at the Twenty-eighth Annual Meeting, American Roentgen Ray Society, Montreal, Canada, Sept. 20–23, 1927.

The cholagogues used were as follows:

(1) Calomel
(2) Sodium salicylate
(3) Sal cathartic
(4) Sodium phosphate
(5) Seidlitz powder
(6) Hydrochloric acid
(7) Podophyllin
(8) Pituitrin
(9) Bile salts
(10) Oleic acid
(11) Olive oil
(12) Olive oil emulsion
(13) Castor oil
(14) Cod liver oil emulsion

(1) Calomel followed by examinations from one-half to six hours after administration caused no apparent change in the size of the gall-bladder. It appeared, however, to set up some activity, as was noted in all cases by changes in the form of the gall-bladder and in one case by an increase of the concentration of the bile.

(2) Sodium salicylate up to two hours caused no change in the shadow obtained.

(3) Sal cathartic (similar to Carlsbad salts) caused no response.

(4) Sodium phosphate up to four hours had no apparent effect on the gall-bladder.

(5) In the one case which received a seidlitz powder, at the sixteenth hour we noted a slight increase in concentration but no change in the size or form.

(6) Hydrochloric acid gave no response in the way of emptying. One patient examined four and a half hours after 30 minims of dilute hydrochloric acid showed an *increase* in the size of the gall-bladder and a marked concentration of its contents.

(7) In the one case in which podophyllin was given, the gall-bladder four hours after was very much more distended with bile than before the drug was administered.

(8) Pituitrin was not responsible for any emptying at examinations made from thirty minutes to two hours after its administration. Definite activity was seen in 2 of the patients; in one it manifested itself by a pointing of the fundus; in the other, there was a strong suggestion of peristaltic waves in the outline of the gall-bladder.

(9) Several varieties of bile salts were used and examinations continued from the first to the sixth hour. No response was obtained at any time. The gall-bladder remained full and showed no sign of activity.

(10) Of all the drugs used, oleic acid caused the most marked response. In one case the gall-bladder emptied completely within three hours. There was a refilling at the eighth hour, probably from resorption. In another case there was a marked increase in concentration at the fourth hour.

(11) Olive oil administered in its pure state caused a reduction in the size of the gall-bladder within one hour. In one case increased concentration was noted at the second hour. Another case showed partial emptying even with the presence of stones.

(12) The emulsified olive oil caused a greater degree of emptying than was seen after the administration of the pure olive oil. There was a suggestion of a wave noted at one of the examinations.

(13) Castor oil up to four hours caused practically no change in the size or shape of the gall-bladder. In one patient a slight increase in concentration occurred at the fourth hour. Two hours later, with continued starvation, there was a slight diminution in the size.

(14) Two hours after 2 oz. of cod liver oil emulsion was given there was no cholecystographic change in the size, shape or density of the gall-bladder.

CONCLUSIONS

Of the fourteen substances used a most constant response was obtained from oleic acid.

Olive oil pure or emulsified showed some emptying power.

With the exception of oleic acid none of the drugs used caused as great or as rapid emptying as a simple meal. Singularly enough, this fact was stated by B. Naunyn in his famous monograph on "Cholelithiasis" published in 1892 and his deductions were entirely from clinical observations. The act of digestion is the necessary factor in gall-bladder emptying.

No reaction whatever was obtained from the following: castor oil; sodium salicylate; bile salts; sal cathartic; seidlitz powder; sodium phosphate.

Where podophyllin and dilute hydro-

chloric acid were given patients with dilatable gall-bladders the bile content was apparently increased.

Calomel and pituitrin, although not causing emptying, did appear to excite the gall-bladder to activity as was seen in changes in size, form and concentration. In some of the patients an actual peristalsis was suggested.

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ABSTRACT OF DISCUSSION OF PAPERS BY DRS. SKINNER, LOCKWOOD, AND DEWEESE, AND STEWART AND RYAN

Dr. M. C. Sosman, Boston, reported work on the gall-bladder which he had done in conjunction with a surgeon and an anatomist. Their work had demonstrated that most drugs have no effect on the emptying of the gall-bladder, with possibly the exception of sodium bicarbonate and alcohol, both of which seemed to have a relaxing effect. Their work seemed to prove that the effect was not mechanical, that is, not due to the passage of food over the sphincter which controls evacuation. A patient who had had a gastroenterostomy and transection of the pylorus showed a very prompt emptying of the gall-bladder following the usual fatty meal. This was later confirmed in dogs. Dr. Whitaker transected the pylorus and did a gastroenterostomy 3 or 4 feet beyond the pylorus and obtained very prompt contraction of the gall-bladder after feeding the animal. As he had previously reported, he has found fat the most effective of any food in bringing about evacuation of the gall-bladder. Another method for studying the physiology of the gall-bladder was devised by Whitaker and consisted in opening the abdomen of the animal, emptying the gall-bladder by a small syringe, filling it with lipiodol and then after the animal had recovered from the operation and the gall-bladder shadow had remained unchanged for days, a feeding of egg yolk was given. This resulted in very rapid emptying so that the common duct and at times the hepatic duct could be demonstrated on the roentgenogram. Dr. Sosman stated that a by-product of the work of Drs. Whitaker and Boyden related to the rôle played by the sphincter of Oddi. When the sphincter is cut a gall-bladder shadow can never be obtained.

Dr. James T. Case, Battle Creek, Mich., stated that he could add to the list of drugs tested by Dr. Stewart, Russian mineral oil, which was found to have no effect whatever on the emptying time of the gall-bladder. Dr. Case also emphasized the importance of regular meals in order to secure periodic emptying of the gall-bladder.

Dr. George W. Holmes, Boston, suggested that if long-continued fasting is likely to produce gallstones, those persons who go on long-continued fasts may be especially prone to have them. Dr. Holmes, in discussing Dr. Skinner's paper stated that he had had cases very similar to those of Dr. Skinner. He had reviewed 50 of his cases of duodenal ulcer who had also had Graham tests but had been unable to arrive at any definite conclusion. There seemed to be no constant relation between the state of activity of duodenal ulcers and the filling of the gall-bladder.

Dr. Webster W. Belden, New York City, stated that his own experience corroborated that of Dr. Skinner, that with lesions at the pylorus there is likely to be interference with normal gall-bladder filling.

Dr. David S. Dann, Kansas City, Mo., stated that he had recently had a case which might throw some light upon the problem raised in Dr. Skinner's paper, a case of acute perforating ulcer of the duodenum. The dye was given orally and the gall-bladder did not fill. On microscopic section of the removed gall-bladder the wall contiguous to the duodenum showed a hemorrhagic infiltration of the serosa. In the remaining portion of the gall-bladder, practically three-fourths of it, the gall-bladder wall was perfectly normal. He thought that this finding might be of some value when taken in conjunction with the work of McMaster which showed that if the gall-bladder is injured ever so slightly in dogs, there is no concentration or filling.

Dr. Stewart, in discussing Dr. Skinner's paper, stated that he had observed no instance among his own cases in which he had failed to obtain a gall-bladder shadow in the presence of duodenal ulcer.

DIAGNOSIS OF TUMORS OF THE KIDNEY PELVIS*

BY A. I. DODSON, M.D., J. L. TABB, M.D., AND A. L. GRAY, M.D.

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RICHMOND, VIRGINIA

TUMORS arising in the pelvis of the kidney are relatively rare, but are probably much more frequent than is generally believed. The failure to find them is due not so much to their infrequent occurrence as to the failure to examine completely every patient complaining of lumbar pain or hematuria.

The examination must consist not only of physical and the usual pathological laboratory methods but must also embrace roentgen-ray studies of the urinary tract including a pyelogram of the affected kidney, if the kidney is found to be the probable source. Blood in the urine is a fairly frequent symptom. It may arise from the kidney, bladder, ureter or urethra and is a warning of danger too great to be disregarded in any instance. When the bleeding is found to come from a point above the bladder only roentgen-ray studies can be expected to clear up the question of the cause and designate treatment that should be instituted.

Thomas and Regnier[1] published studies of 253 tumors of the kidney pelvis and ureter of which 5 were their own cases. They call attention to the infrequency with which a diagnosis was made in these cases prior to operation.

Smith and Gilbert[2] described a case of malignant papilloma of the kidney pelvis. They were able to find in literature 178 cases of tumor primary in the kidney pelvis, 142 were of the papillary type and 36 of the non-papillary type.

Meltzer[3] reported a case of papillary carcinoma of the renal pelvis. He found after study of the literature that only 5 to 7 per cent of kidney tumors arise in the pelvis of the kidney.

Scholl[4] reported 8 cases of papillary tumor of the kidney pelvis, giving a thorough description of their pathology. These patients were seen in the Mayo Clinic during a period of seventeen years.

The pathology of tumors arising from the renal pelvis is similar to that of tumors arising from the bladder. Ewing[5] classifies them as follows:

A. Papilloma
B. Papillary epithelioma
C. Alveolar carcinoma

Regardless of the histological characteristics, their clinical behavior divides them into two classes. The papillomatous type, which bleeds freely and early, which is often transplanted to the ureter and bladder and which metastasizes late; and the flat infiltrating growth which spreads to the ureter only by extension, which bleeds less readily and metastasizes early. These differences materially affect the treatment and prognosis.

Like tumors elsewhere, the etiology of these growths is not known. They most frequently occur during the third and fourth decades of life. In the majority of instances some infection of the kidney pelvis is present. Stones in the kidney are not infrequent. It is therefore probable that prolonged irritation is an etiological factor.

The outstanding symptoms of tumor of the kidney pelvis are hematuria, pain and a palpable mass. Bleeding occurs early in the papillary type and is present in at least 70 per cent of all cases. In the non-papillary type it occurs in about 50 per cent of cases. Patients frequently complain of a dull pain in the lumbar region. Kidney colic is rare, but it occasionally occurs, resulting from a detached fragment of the growth or a clot becoming lodged in the ureter. The dull pain is probably due to tension in the kidney pelvis resulting either from partial obstruction to the outflow of urine or tension resulting from the growth. A palpable mass is a late symptom resulting from invasion of the cortex or hydronephrosis.

The diagnosis depends principally upon cystoscopic examination and roentgen-ray studies. The bladder mucosa may be

*Read at the Twenty-eight Annual Meeting, American Roentgen Ray Society, Montreal, Canada, Sept. 20-23, 1927.

entirely normal or there may be some congestion about the trigone if bleeding has been profuse or if marked infection is present. Immediately following profuse bleeding or during an attack, congestion and edema about the ureteral orifice will probably be present. There may be definite spurts of blood from the ureter on the affected side or occasional stringy blood clots hanging from the ureteral orifice.

Usually the ureter is catheterized without difficulty. At times some obstruction may be met caused by the presence of clots or transplantations. There will usually be marked diminution of kidney function on the affected side. In the case here reported there was pronounced infection of the pelvis of the involved kidney and diminution in function. This was in spite of the fact that the growth was small and was not producing material pressure on the kidney substance nor obstruction to the outflow of urine. The phenolsulphonephthalein output on the affected side was only 3 per cent in fifteen minutes, while the opposite kidney eliminated 8 per cent.

The roentgen-ray diagnosis in these cases depends upon finding a filling defect in the opaque solution, the defect corresponding in shape, size and location to the tumor. No definite characteristic picture can be described in the early cases, first, because no two tumors are exactly alike in shape, size and location, and second, because there are not even the general roentgen findings which are usually presented by renal neoplasms. The kidney is not displaced and the major calyces have not the narrow, curved and "spider leg"[6] appearance commonly present in extrapelvic tumors. Later, after the tumor has attained considerable size, there may be marked distortion of the calyces. The filling defect must, if possible, be differentiated from the negative shadow of a non-opaque calculus, and clinical signs and symptoms should be most carefully considered before reaching a conclusion.

Fig. 1. Pyelogram of left kidney showing deficiency in filling the pelvis and upper calyces.

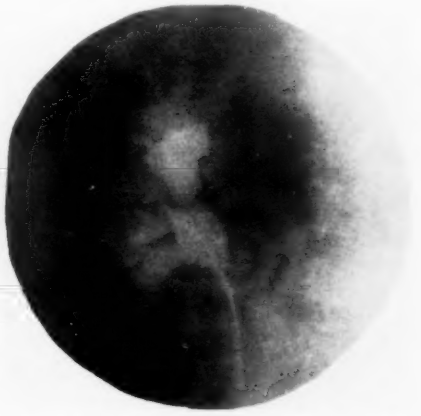

Fig. 2. Pyelogram of right kidney showing slightly enlarged upper calyx. Patient very obese.

In the roentgen-ray examination of our cases in which an opaque catheter or solution is introduced into the ureter or pelvis, the roentgenoscope plays a prominent part and has done so for many years.[7] The leaded catheter having been introduced, the patient is examined roentgenoscopically and if the catheter is too high in the pelvis it is withdrawn to about the first sacral segment. The withdrawal of the catheter can be readily controlled by observation with the roentgenoscope. The opaque solution is now allowed to run by gravity and the pelvis is carefully watched while filling. When the pelvis is full the injection is stopped though the patient may not have complained of pain—a fact of great advantage in roentgenoscopically controlled pyelograms. The pelvis may be seen to be filled completely before the patient experiences material

pain. Pain is an indication of an over-distended pelvis and not of a completely filled pelvis. By this method the severe kidney colic is usually prevented and satisfactory films may be secured with greater certainty, since the patient is not writhing and gasping with pain. Again, the diagnosis of a pathological kidney pelvis can usually be made under the roentgenoscope, and in the event that the films fail to show a clear outline of the pelvis the cystoscopic and roentgen-ray examinations would not have been in vain. The roentgenolgist must be careful to spend sufficient time in a dark room to secure the proper sensitization of his retina before undertaking these examinations, otherwise the roentgenoscopic observations will be unsatisfactory.

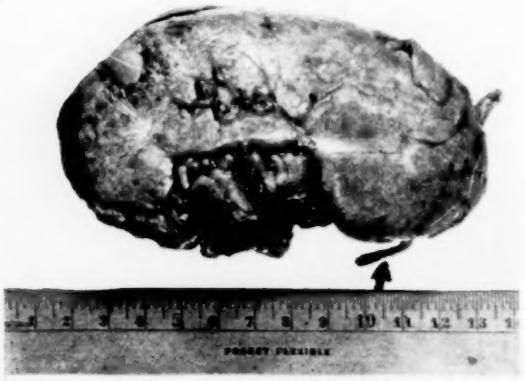

Fig. 3. Left kidney after removal, showing anomalous artery.

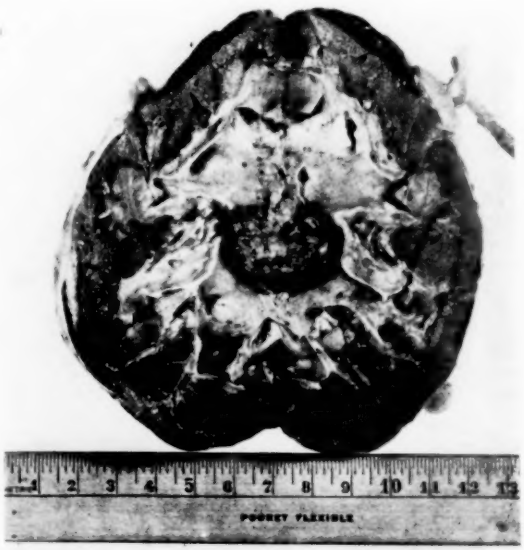

Fig. 4. The kidney split through the cortex showing tumor in the pelvis.

CASE REPORT

Mrs. H., white, aged fifty, entered St. Luke's Hospital January 11, 1927, complaining of pain in the back and blood in the urine. Her history is as follows:

Family history negative. Patient was operated on at St. Luke's Hospital seven years ago for gall-bladder disease. She made a satisfactory recovery and her health has since been good. About three months ago she began to experience a dull, aching pain in the left lumbar region. Three weeks ago she noticed a large amount of blood in her urine. It disappeared for several days and then she began to notice it every other day. The urine would appear to contain a large amount of blood and it would gradually clear up, becoming entirely clear for a few hours. Bleeding has never been accompanied by pain.

Physical examination was insignificant except for extreme obesity, some edema of the extremities and tenderness around the left costal margin.

Laboratory examination. Blood count is normal. Blood Wassermann negative. Nonprotein nitrogen 63 mg. per 100 c.c. Urine slightly cloudy. Specific gravity 1.007, slightly acid. Albumin, distinct trace. Sugar negative. Five red blood corpuscles and numerous leucocytes to the high power field. Phenolsulphonephthalein test showed 15 per cent first hour, 22 per cent second hour.

Cystoscopic examination on January 11 showed bladder mucosa mildly congested throughout. Both ureteral orifices normal in location and appearance. No growth nor ulcer could be found on bladder wall. Both ureters catheterized without difficulty with No. 6 catheter. Specimens collected were cloudy. Specimen from left kidney contained numerous leucocytes; specimen from right kidney contained few leucocytes. There were a few red blood cells in each specimen. Indigo carmine given intravenously appeared in five minutes from the right and in ten minutes from the left. Pyelogram on January 13 showed a marked defect in outline of left kidney pelvis.

On January 15 cystoscopy was repeated. Both ureters catheterized and phenolsul-

phonephthalein test made. The dye appeared in six minutes from both kidneys. At the end of fifteen minutes 8 per cent was collected from the right kidney and 3 per cent from the left kidney. A pyelogram of the right kidney was made at this time which was essentially negative.

Roentgen-ray examinations were reported as follows:

Films of the urinary tract, after introduction of opaque catheter on the left side, show a somewhat irregular outline of the kidney through which a calcareous ring-like mass is seen (Fig. 1). After injection of opaque solution roentgenoscopic examination shows a very irregular pelvis apparently obliterated in its upper mesial portion. The infundibulum is irregular and the upper calyx does not fill.

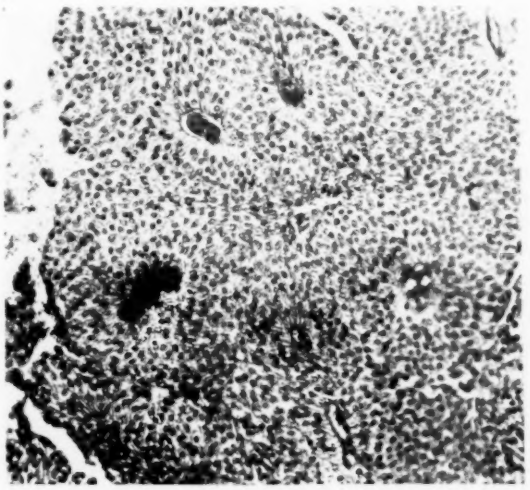

Fig. 5. Photomicrograph of tumor. Note the capillaries on cross section in the stromal arborizations and the abundant epithelium surrounding them.

Pyelogram of right kidney shows pelvis approximately normal except that the upper calyx is somewhat larger than the average (Fig. 2).

Conclusion. Patient has a pathological left kidney which is probably in the nature of a tumor involving its upper inner pole at or near the pelvis.

The following conclusions were drawn: A history of free painless bleeding coming on suddenly and stopping suddenly, together with marked filling defect of left kidney pelvis, indicates tumor of the left kidney, probably a papillary growth of the left pelvis, since the kidney outline seems to be normal.

On January 18, 1927, a left nephrectomy was done by Dr. Stuart McGuire. Dr. S. W. Budd submitted the following report:

The kidney measures 11 × 5 × 3.5 cm. The capsule stripped from the kidney with ease. At the upper pole of the kidney there is a large hemorrhage lying between the kidney surface and the capsule. Near this hemorrhage is an anomalous artery (Fig. 3). The cutting of this artery led to a profuse hemorrhage at the time of operation. The artery projects from the upper pole of the kidney and is at a distance from the pelvic vessels. On stripping the capsule the surface of the kidney showed a mottled appearance due largely to small cortical hemorrhages.

There are several distinct miliary tubercles on the surface of the kidney at the superior pole. These tubercles lie just beneath the surface and are surrounded by a hemorrhagic zone. The kidney shows a moderate degree of fetal lobulation. On splitting the kidney a tumor measuring 2.5 × 2.5 × 1.5 cm. is seen at the ureteral orifice. The tumor is a coarse, villous growth, pedunculated, pinkish in color, soft and presents a typical cauliflower appearance. The peduncle of the tumor is quite short, less than 0.5 cm. in length. The diameter of the peduncle is about 1 cm. Where the tumor is joined to the pelvis there is considerable induration and invasion but the invasion is confined to the medullary portion of the kidney (Fig. 4). There are no secondary growths nor invasions other than the one mentioned above.

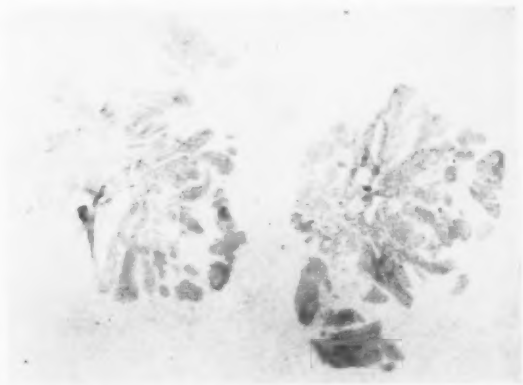

Fig. 6. Print from microscope slide showing villous structure of tumor.

The kidney substance presents a normal appearance. The cortical and medullary markings are readily made out and are normal. The pelvis is about the usual size and presents a healthy appearance.

Microscopic examination of the tumor shows it to consist of a branching stroma covered by many layers of epithelium. The stroma is limited in amount and embryonic in character. There is always a capillary to be seen in the

stromal arborizations. The epithelium appears very active and overnourished. The nuclei are hyperchromatic and there are numerous evidences of mitosis. The prophase forms seem to predominate. In the stroma there are to be seen many polymorphonuclear leucocytes and a few round cells. The kidney cortex, except for the miliary tubercles, presents a healthy appearance.

Diagnosis. Papilloma of the kidney pelvis. Tuberculosis of the cortex (several miliary tubercles.)

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METROSALPINGOGRAPHY WITH THE AID OF IODIZED OIL*

BY I. C. RUBIN, M.D., AND A. J. BENDICK, M.D.

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THE introduction of lipiodol into roentgenology by Sicard and Forestier in 1922 gave a new stimulus to roentgen-ray diagnosis in gynecology. Other radiopaque solutions have been in use for years, but the superiority of iodized oil placed the roentgen study of the uterus and tubes on a practical basis. During the past three years there has been intensive study of these organs by many men and in consequence our knowledge of their anatomy, physiology and pathology is changing considerably. We must remember that in these studies the organs are in their normal position supported by muscles and ligaments, the patient is not relaxed artificially by an anesthetic and the abdominal pressure is not changed as during an abdominal operation.

One must remember, however, that we never see by this method the uterus or tubes themselves. What is visualized is their lumen—a perfect cast of the cavities is seen. This corresponds to our examination in gastrointestinal diagnosis and suffices for accurately determining size, position and shape of the organs and any masses projecting into the lumen.

The uterine cavity is triangular in shape, the intrauterine diameter averaging about 4 cm. in width, the narrowest portion being at the internal os. The length of the uterine cavity is about 5 cm. One must remember, however, that this size is determined when the uterus is subjected to a pressure of about 100 mm. of mercury.

The tube can best be considered as composed of two parts—the isthmus and ampulla. The isthmus can be subdivided into an intramural portion (pars uterina) and the isthmus proper. The ampulla can be separated into the ampulla proper and fimbria (or infundibulum).

The intramural portion in most of our cases was clearly visualized whenever any lipiodol entered the tube. This part is small, in our opinion much shorter than the work of others would indicate, varying from 0.5 to 1.5 cm. It often shows two constrictions, one at each end, so that it tends to assume a triangular appearance, the base of the triangle being towards the uterine cavity. Sometimes only one constriction is seen and in a few cases it appeared as a continuous band and could not be separated into its two component parts. The angle at which it leaves the uterine cavity varies slightly. It usually shows a gentle curve downwards and outwards. In none of our cases have we seen numerous curves and angles as described by some authors.

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The isthmus proper is visualized as a narrow band often hair-like, sometimes as broad as 2 mm. It varies in length from 3 to 10 cm., its average length being about 5 cm. Its direction is usually downwards and outwards, and seldom shows any sharp angulations.

The ampulla is much wider and always appears irregularly coiled, changing its position and shape, owing to its vigorous peristalsis. Its usual width is about 5 mm. and in length varies from 4 to 10 cm. It outlines. Slight changes were noted, but we have never seen any evidence of a peristaltic wave. It is known that the uterus does contract and in our work it always expels the oil soon after the pressure is released, but it probably contracts as a unit and is unable, so far as we have been able to observe, to do so under the pressure maintained during the injection.

The intramural portion, as we have stated, usually shows two constrictions—

Fig. 1. Post mortem injection of specimen showing normal course of tubes.

should be remembered, however, that these observations have been made in cases of tubal closure and not in patent tube cases.

The fimbria can be seen as a triangular mass, on one side often showing the curve corresponding to the surface of the ovary.

We now come to the question of peristalsis of the different parts:

The Uterus. We have made prolonged roentgenoscopic observations and at no time were we able to see a contraction of its walls. Moreover we made serial roentgenograms at definite intervals, taking as many as eighteen films, each twenty seconds apart, and compared the uterine one at the apex and the other at the base of the triangle. These constrictions never disappeared or changed their shape. They always showed the same conformation on re-examination. The data at present available do not permit a decision as to whether these points of narrowing are anatomical or physiological. We are making this point the subject of further investigation.

The Isthmus Proper. This shows good muscle tone. It can be dilated only slightly and usually empties as soon as the pressure is released. It does not show definite peristaltic waves.

When we come to the ampulla, it is quite different. Peristalsis always occurs

in the normal tubes, and can be observed under the roentgenoscope or demonstrated on films. By some it has been called "excess." Numerous waves are seen, as many as five being visualized at one time. Due to the coiled position of the ampulla it is more difficult to state the direction of the wave. Both peristalsis and antiperistalsis probably occur. Lipiodol remaining in the tubes after all pressure is released and after the uterine cavity is empty, may be forced either back into the uterine cavity or out into the peritoneal cavity. Those waves that were most clearly visualized seemed to begin near the fimbria progressing towards the uterus. The rate was about ten per minute. In some cases, roentgenoscopically, the ampulla showed a definite writhing motion probably due to contraction of longitudinal muscle fibers. We must remember, however, that we are here studying the tubes under abnormal conditions, that is, they contain a foreign body and this vigorous peristalsis may be only an effort to rid itself of the lipiodol. When the ampulla is dilated it seldom shows peristalsis.

Peristalsis in the infundibulum could not be satisfactorily studied. If the tube was patent the solution immediately entered the peritoneal cavity; if blocked, it was seldom visualized. In one case we saw this portion dilate and then suddenly contract and force the lipiodol to the opposite side of the pelvis. This may have been a violent contraction or sudden loosening of the cohesion between ovary and tube by the pressure transmitted through from the syringe.

As to the clinical value of the test, we have found its greatest use in our study of sterility in women. In those patients in whom air insufflation has shown the tubes to be occluded or stenosed, the lipiodol injection enables us to accurately determine the site of obstruction or stenosis, and the question of operation can be much more efficiently judged. If stenosed, the therapeutic air insufflations may be indicated. If the ampulla is dilated and blocked, operative opening up of the ampulla may suffice. If the isthmus is obstructed, re-implantation is indicated.

The test is also of use in determining the size and shape of the uterine cavity, often outlining fibroids or polyps. Visualization of the tubes may show them to be displaced by large pelvic masses. In determining early pregnancy it is almost

Fig. 2. Showing normal division of tube into pars uterina, isthmus, ampulla and fimbria; the ampulla showing peristalsis.

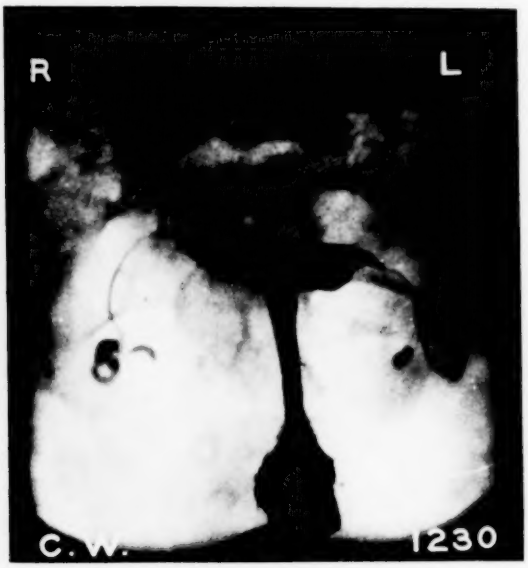

Fig. 3. Showing distinct triangular shadow of pars uterina with two points of constriction.

conclusive, but the dangers of causing the patient to abort are too great to warrant its use as a routine procedure. The question has been asked as to how long lipiodol remains in the body. The uterus usually empties itself within ten minutes. The normal tubes express it after several hours either into the peritoneal cavity or uterus. When the fimbria is blocked and the ampulla dilated it may remain for months or even years unchanged. When it is in the peritoneal cavity it is gradually emulsified so that it cannot be visualized and is probably slowly absorbed.

In the few cases where we have allowed the lipiodol to enter the peritoneal cavity we have obtained distinct signs of peritoneal irritation. They complained of cramps the following day, but were never too sick to reappear at the office for re-examination.

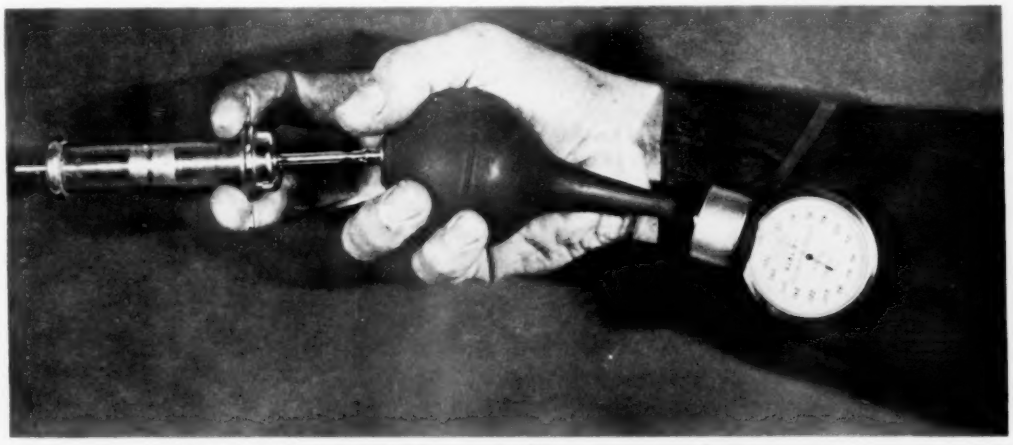

Fig. 4. Showing method of controlling pressure with manometer.

TECHNIQUE

This has already been described by others as well as ourselves and we need not here go into details. We would like, however, to stress two points:

1. The advantage of controlling the injection under the roentgenoscope. This enables one to judge just how much pressure is needed and to stop immediately if any enters the peritoneal cavity.

2. Controlling the pressure of injection. By simply interposing a small rubber bulb between the thumb and the syringe piston and connecting this bulb to a manometer, we are able to read directly the pressure. By having a radium dial on the manometer we can readily see it in the roentgenoscopic room and so the pressure at all times is under complete control. The elasticity of the rubber bulb introduces a small error in reading, but this is constant and unimportant. We have used pressure varying from 80 to 200 mm. of mercury (see Fig. 4).

ABSTRACT OF DISCUSSION

Dr. James W. Duncan, Montreal, agreed with Drs. Rubin and Bendick that the technique of metrosalpingography is not difficult. He stated that in his own work he had not attempted to determine the patency or occlusion of the Fallopian tubes without an anesthetic. He had not found that the anesthetic interfered with the work and he thought it enabled them to immobilize the patients more readily. Dr. Duncan emphasized the importance of making a roentgenogram twenty-four hours after the instillation of the lipiodol in cases where there is apparent occlusion when the first roentgenograms are made. Free lipiodol is often found in the peritoneal cavity twenty-four hours after the injection when there is apparent occlusion of the tube at the first examination. The frequency of this occurrence had led him to speculate as to the possibility of the presence of a distinct sphincter at the distal end of the ampulla. Dr. Duncan also emphasized Dr. Bendick's statements with regard to the persistence of the lipiodol in the peritoneal cavity for long periods after the

injection but none of his patients had had any symptoms referable to its presence there.

Dr. G. E. Pfahler, Philadelphia, asked if sterility had been observed in any cases following the injection of lipiodol or whether there was evidence that the injection does not produce any such effect.

Dr. Charles Martin, Dallas, Texas, requested information as to any possible treatment that might be instituted for relief of the occlusion of a tube once it was discovered. Dr. Martin also asked whether spasm of a tube could give the picture of organic occlusion.

Dr. E. C. Brooks, Montreal, commenting on Dr. Pfahler's question with regard to sterility stated that 3 of his own cases who had been examined by this method had since become pregnant, 2 of whom had gone to full term and one had aborted.

Dr. Bendick, in closing, again emphasized the importance of an examination twenty-four hours after the injection. If no lipiodol enters the peritoneal cavity immediately after injection and the twenty-four hour film shows lipiodol in the cavity that tube is considered patent but stenosed. Dr. Bendick stated that a small amount of lipiodol lodged high up in the vault of the vagina to one or the other side may very closely simulate lipiodol in the peritoneal cavity. He had seen this mistake made and cautioned against it. He could give no information with regard to the possibility of sterility following the injection; all of his cases had come to examination complaining of sterility. If the tubes were patent to gas, lipiodol was not injected. Two of his cases have become pregnant subsequent to the lipiodol injection. He stated in answer to Dr. Martin's question that he had never observed a spasm that had persisted or changed in the isthmus or ampulla. Whether the two constrictions which he had described in the pars uterina are due to spasm or normal tone he was not able to answer. With regard to surgical relief when the tube was found occluded, he stated that there was possibly indication for operation if the ampulla is dilated and blocked near the fimbria, provided not too much is attempted in the way of surgery. When the tubes are both occluded at the uterine end, nothing of value can be accomplished except transplantation of an ovary into the uterine cavity.

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Information of interest to all readers will be found on page ii.

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Twenty-ninth Annual Meeting: Kansas City, Mo., Sept. 25–28, 1928.

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EDITORIALS

PAGET'S DISEASE OF BONE AND OSTEOGENIC SARCOMA

OSTEITIS deformans, or Paget's disease, was first described by Sir James Paget in 1876. Recognition of the disease has been much more frequent since the use of the roentgen ray for diagnosis, but very little has been added to our knowledge of its real nature since the publication of Paget's classic description. Reports by various writers indicate that osteitis deformans has an incidence of approximately one to every ten thousand hospital admissions. The fact, however, that many patients with the disease never enter hospitals and that it is usually recognized only after it becomes advanced leads many writers to believe that it is a much more common disease than the hospital statistics indicate.

Sir James Paget himself believed that there is probably an intimate relationship between osteitis deformans and malignant tumors. In 1901 Packard, Steele and Kirkbride[1] in reviewing the literature, found 66 cases of Paget's disease, 7.5 per cent of which were complicated with osteogenic sarcoma, and 4.5 per cent by carcinoma in some part of the body. The general opinion now seems to be that since Paget's disease nearly always occurs in middle life or beyond, carcinoma is probably no more frequent than in the general population at that age. On the other hand, reports made since that of Packard, Steele and Kirkbride indicate that the incidence of osteogenic sarcoma in osteitis deformans is even higher than the 7.5 per cent found by them. It seems quite certain that the incidence is much higher than in the general population at the age when Paget's disease usually occurs, since bone sarcoma is a disease of childhood and early adult life.

During the past few years a considerable number of cases of osteogenic sarcoma have been reported in bones which were the seat of Paget's disease. Bird[1] in 1927, made a thorough study of the records of four of the large hospitals of Boston. His study revealed in the records of these hospitals (Peter Bent Brigham, Boston City, Massachusetts General and Huntington Memorial) sixty-four cases of Paget's disease. Five of these cases were complicated with osteogenic sarcoma superimposed on bones which were the seat of Paget's disease. In addition to the five cases discovered in the records he reports two cases which came under his personal observation at the Peter Bent Brigham Hospital, one of sarcoma of the skull and the other of the ilium, both of them in patients with extensive Paget's disease. This gives an incidence in the four hospitals mentioned of approximately 10 per cent. The average age of recognition of these tumors was fifty-seven years, the oldest sixty-nine and the youngest thirty-six. Bird contrasts this with the average age given by Gross[2] for bone sarcomas which was twenty-three years, the youngest aged twelve and the oldest fifty-five.

Bird also investigated the records of the Registry of Bone Sarcoma in which he found among the 670 cases recorded three cases of malignancy superimposed on Paget's disease. These three cases were in patients aged respectively sixty-nine, fifty-six and forty-five years. In addition, therefore, to the high percentage of cases of sarcoma found in patients with Paget's disease, the above figures showing its occurrence at ages when osteogenic sarcoma does not usually occur are evidence that Paget's disease predisposes to occurrence of bone sarcoma.

Bird makes an important observation with regard to examination of these patients, namely, that when roentgenograms are made disclosing an osteogenic

[1] Packard, F. A., Steele, J. D., and Kirkbride, T. S. Osteitis deformans. *Am. J. M. Sc.*, 1901, cxxii, 552.

[1] Bird, Clarence E. Sarcoma complicating Paget's disease of bone. Report of nine cases, five with pathologic verification. *Arch. Surg.*, 1927, xiv, 1185.

[2] Gross, S. W. Sarcoma of long bones, based on a study of one hundred and sixty-five cases. *Am. J. M. Sc.*, 1879, lxxviii, 157-57; 338-377.

sarcoma the evidences of Paget's disease may be very slight in that particular region. This may be due either to the fact that that particular bone may have been only slightly involved at the time of examination or that the sarcomatous growth has become so extensive as to obliterate the original evidences of Paget's disease. It is therefore important in the interests of accurate diagnosis in patients beyond the usual sarcoma age to make examination of other bones of the body, especially of the pelvis and the skull.

An unreported case which illustrates this point has recently come under the observation of the writer. Roentgenogram of the elbow of a man about fifty-five years old showed a typical osteogenic sarcoma of the lower extremity of the humerus. His history showed that he had been examined about a year previously and diagnosis made of fracture of the internal condyle of the humerus. Examination of the films made at the time of the fracture showed a distinct pathological change in the bone, which had been overlooked, and examination of the pelvis showed extensive typical Paget's disease of the entire pelvis, the lower spine and both femurs.

There seems no doubt from the increasing number of reports of cases of osteogenic sarcoma accompanying osteitis deformans that bone sarcoma in Paget's disease is much more common than has been supposed and probably somewhat above the 10 per cent indicated by Bird's study of the Boston hospital records. It is certainly of sufficient frequency to warrant a search for Paget's disease in every case of bone sarcoma occurring in patients beyond the usual age for sarcoma.

Incidentally, attention is again called to the increasing value of the Registry of Bone Sarcoma. As stated above, investigation of the cases in the Registry disclosed three cases of the condition here under discussion. It is important that everyone who discovers a case of bone sarcoma send in a complete report of it to the Registry. The ultimate value of a large number of completely studied cases of a disease about which so little is known cannot be overestimated.

SECTION ON RADIOLOGY
AMERICAN MEDICAL ASSOCIATION

The interest in the meetings of the American Medical Association on the part of radiologists has been very greatly increased since the formation of a Section on Radiology. The attendance at the meetings of this section, although it has been in existence for only a few years, has been very large. The existence of a Section on Radiology in the American Medical Association gives to roentgenology and radium therapy an official recognition which it has never before had. It is important that radiologists in all parts of America attend the meeting and support the section by their presence and by their contributions to the program. The program for the section this year is in the hands of the chairman, Dr. E. H. Skinner, Kansas City, Mo., and the secretary, Dr. Fred Hodges of Richmond, Va. The American Medical Association meets in Minneapolis, Minn., June 11–15, 1928, and the meetings of the Section on Radiology will probably be as heretofore on the afternoons of Wednesday, Thursday and Friday of the week of the meeting.

THE HISTORY OF ROENTGENOLOGY
REQUEST FOR CONTRIBUTIONS

In the February and March numbers of the Journal short historical sketches were published on the early development of roentgenology. They were not intended to be exhaustive or complete but it was hoped that they would stimulate many of our older readers to review their own early experiences and contribute articles to the Journal that would in the future serve as sources for roentgenological history. We shall publish in a short time an article by Dr. Hickey recounting some of his own personal recollections and also embodying correspondence with several of the American pioneer roentgenologists. Dr. Thurstan Holland is also preparing an article which will embody the personal experiences of one who has been very active in roentgenology from its earliest days down to the present time.

Subscribers to this Journal are found in all parts of the world and it is hoped that contributions to roentgenological history will be sent in from many different countries. Not only exhaustive articles on any phase of the development of roentgenology or its history in any particular nation, but also short notes on special subjects will be gratefully received.

SAMUEL STERN

1875–1927

Dr. Samuel Stern, for many years a member of the American Roentgen Ray Society, passed away suddenly on November 22, 1927, after a brief illness. His death, though not entirely unexpected, came as a severe shock to his friends who had seen him but a week before out of bed and attending to his work.

As one of those who had the privilege of knowing him for nearly twenty years, I feel that his passing at the early age of fifty-two years was a great loss to radiotherapy. His activities in this field were of a high order, and many of his contributions, though not startling nor epoch-making, were original. He, for instance, anticipated Kienböck in advocating the use of photographic methods for measuring dosage. But unlike the German photographic manufacturers who co-operated with Kienböck in preparing a standardizing photographic paper, American manufacturers would not go to the trouble and expense of producing the necessary materials for measurement. As far back as 1904 he devised in conjunction with R. & F. Wappler, the unipolar roentgen-ray tubes for use in body cavities. Many years ago he experimented with supersoft radiation or roentgen rays of very low voltage, the kind that are now being investigated by others who have the advantage of the improvements made in tube and generator construction.

His work was always individual, even in the hospital. He did not consider it beneath his dignity to look out for the safety of a patient by watching the apparatus, and that perhaps accounts for the infinitely better results he obtained than did others in such delicate work as the treatment of hypertrichosis. These were so good that many almost refused to believe it.

His contributions to the literature were many. To pick but a few of the most important ones: His last was a paper on "Radiotherapeutic Abortion," presented at the Montreal meeting in September, 1927, of the American Roentgen Ray Society, and published in the February, 1928, number of this Journal. It is the first work of this kind done systematically in this country, and the first anywhere in which such uniformly good results were obtained. He published his work with the unipolar roentgen-ray tube in 1904, his first paper on hypertrichosis in 1912, and collaborated with the late Dr. Charles Warrenne Allen in a book on "Radio-Therapy and Photo-Therapy," which was published in 1904.

Dr. Stern was born in Budapest on May 9, 1875, and received his first education there. Later he attended the public schools of New York and graduated from the College of Physicians and Surgeons, Columbia University, with the degree of M.D. in 1896. For many years before he became radiotherapist to the Mount Sinai Hospital he had been connected with the dermatological clinic of Dr. Lustgarten at the Mount Sinai Dispensary. In 1910 he was made radiotherapist to the hospital, and also chief of the radiotherapy clinic in the dispensary which was established soon thereafter. In 1924 his efforts were rewarded by the installation in the radiotherapy department of two high voltage treatment outfits and the consequent establishment of an up-to-date department. It is sad indeed that when the time is at hand for the evaluation of the results obtained under his direction he should not be with us to see how well he planned and worked.

L. Jaches, M.D.

T. V. WILLIAMS

1862–1927

Dr. T. V. Williams, a pioneer in roentgenology, died in New Castle, Penna., December 21, 1927. He was born in Llandebie, Wales, February 24, 1862, and graduated in medicine at the College of

Physicians and Surgeons, Baltimore, in 1892. After graduating he practiced a while at Glen Lyon, Penna., and then moved to Nanticoke, where he installed his first roentgen-ray apparatus, a static machine, in 1897. With this equipment he could locate foreign bodies and obtain fair pictures of the hands and feet. He purchased new apparatus as it was developed and finally became well known as an efficient roentgenologist. In later years he devoted most of his time to electrotherapeutics, roentgen and radium therapy. With all of his early experimenting with roentgen rays he escaped with a few insignificant burns. Dr. Williams was a firm believer in the small and frequently repeated doses in malignancies and was decidedly against the massive dosage as used today, and he did obtain excellent results by his method.

Dr. Williams was a member of the American Roentgen Ray Society, Pennsylvania State and Lawrence County Medical Societies and the American Medical Association.

J. R. Cooper, M.D.

WALTER STECHOW

1852–1927

Dr. Walther Stechow died at Frankfurt on Main, December 17, 1927, as a result of an apoplectic stroke which he suffered at the end of September. Through his death medicine loses a man whose efforts in the development of roentgenology in Germany were epoch making. He was born on January 25, 1852, at Jarchlin in Pomerania, studied at the Friedrich-Werder Gymnasium in Berlin, and graduated from there in 1870. He chose military surgery as his profession. On August 8, 1874, he obtained the degree of Doctor of Medicine at the University of Berlin with a dissertation on "Amyloid Degeneration." In 1890, he was a member of the great German mission to the Sultan of Morocco. In 1893 he visited the United States of America travelling as far as Yellowstone Park.

His achievements in the application of roentgen rays to military purposes were highly meritorious. In February, 1896, just a few weeks after the discovery of the roentgen-ray, he was entrusted with the organization of a Roentgen Institute in Berlin, for the German Army, and for years after that he devoted all his energies to the development of this new specialty. In numerous publications, as well as in papers read at the medical congresses in Stockholm and in Moscow in 1897, in Madrid in 1898, and in Paris in 1900, he reported on newly achieved results. Of particular importance was his early recognition of edema of the foot as a result of a fracture of the metatarsals. His wide experience in this field he recorded in a special monograph "Das Roentgen Verfahren." German roentgenology has lost in him one of its leading men whose interests until the end were devoted not only to the entire field of medicine, but also to progress in the natural sciences.

Subscribers to The American Journal of Roentgenology & Kadium Therapy *visiting New York City are invited to make the office of the publishers (Paul B. Hoeber, Inc., 76 Fifth Avenue, New York) their headquarters. Mail, packages or bundles may be addressed in our care. Hotel reservations will gladly be made for those advising us in advance; kindly notify us in detail as to requirements and prices. List of operations in New York hospitals on file in our office daily.*

SOCIETY PROCEEDINGS, CORRESPONDENCE AND NEWS ITEMS

Items for this column solicited promptly after the events to which they refer.

MEETINGS OF ROENTGEN SOCIETIES*

United States of America

AMERICAN ROENTGEN RAY SOCIETY
Secretary, Dr. John T. Murphy, 421 Michigan Ave., Toledo, Ohio.
Twenty-ninth annual meeting, Kansas City, Mo., Sept. 25–28, 1928.

AMERICAN COLLEGE OF RADIOLOGY
Secretary, Dr. Albert Soiland, 1407 S. Hope St., Los. Angeles, Calif.
Annual meeting, Minneapolis, Minn., June 13, 1928.

SECTION ON RADIOLOGY, AMERICAN MEDICAL ASSOCIATION
Secretary, Dr. Fred M. Hodges, 801 West Grace St., Richmond, Va.
Annual meeting, Minneapolis, Minn., June 11–15, 1928.

RADIOLOGICAL SOCIETY OF NORTH AMERICA
Secretary, Dr. Robert J. May, St. Luke's Hospital, Cleveland, Ohio.
Fourteenth annual session, Chicago., Ill., Dec. 3–7, 1928.

RADIOLOGICAL SECTION, SOUTHERN MEDICAL ASSOCIATION
Secretary, Dr. E. C. Samuel, New Orleans, La.

BUFFALO RADIOLOGICAL SOCIETY
Secretary-Treasurer, Dr. Joseph S. Gian-Franceschi, 610 Niagara St.
Meets second Monday of each month except during the summer months, the place of meeting to be selected by the host.

CHICAGO ROENTGEN SOCIETY
Secretary, Dr. R. A. Arens, Michael Reese Hospital
Meets monthly on second Thursday from October to May (except during month of December) at Virginia Hotel. Dinner at 6 P.M., scientific session at 8 P.M.

CLEVELAND RADIOLOGICAL SOCIETY
Secretary, Dr. James H. West, 8314 Euclid Ave.
Meetings are held at 6 o'clock at the University Club, on the fourth Monday evening of each month from September to April, inclusive.

DETROIT ROENTGEN RAY AND RADIUM SOCIETY
Secretary, Dr. O. J. Shore, 2033 Park Ave.
Meets monthly on second Friday from October to May, at Wayne County Medical Society Building.

CENTRAL ILLINOIS RADIOLOGICAL SOCIETY
Secretary, Dr. H. C. Kariher, Decatur, Illinois.
Regular meetings held quarterly.

INDIANA ROENTGEN SOCIETY
Secretary, Dr. Carl S. Oakman, Muncie, Indiana.
Annual meeting each February 22 in Indianapolis. Next meeting in June, 1928.

NEW ENGLAND ROENTGEN RAY SOCIETY
Secretary, Dr. M. C. Sosman, Peter Bent Brigham Hospital, Boston, Mass.
Meets monthly on third Friday, Boston Medical Library.

NEW YORK ROENTGEN SOCIETY
Secretary, Dr. E. Everett Rowell, 200 West 59th St.
Meets monthly on third Monday, New York Academy of Medicine.

CENTRAL NEW YORK ROENTGEN RAY SOCIETY
Secretary, Dr. D. S. Childs, 316 Gurney Bldg., Syracuse, N. Y. Three meetings a year—April, August and November.

PACIFIC COAST ROENTGEN RAY SOCIETY
Secretary, Dr. Harold B. Thompson, Seattle, Wash.
Two meetings a year.

ROENTGEN RAY SOCIETY OF CENTRAL PENNSYLVANIA
Secretary, Dr. W. E. Reiley, Clearfield, Penna.
Two meetings a year, April and October.

PHILADELPHIA ROENTGEN RAY SOCIETY
Secretary, Dr. Eugene Pendergrass, University of Pennsylvania, Philadelphia.
Meets monthly on first Thursday evening, Pennsylvania Hospital.

ROCHESTER ROENTGEN RAY SOCIETY, ROCHESTER, N. Y.
Secretary, Dr. James M. Flynn, 282 Alexander St.
Meets monthly on the first Friday evening at 7.45 at the Rochester Medical Association Building.

ST. LOUIS ROENTGEN CLUB
Secretary-Treasurer, Dr. L. R. Sante, Metropolitan Building.
Meets first week of each month. Time and place of meetings designated by president.

TEXAS RADIOLOGICAL SOCIETY
Secretary-Treasurer, Dr. C. P. Harris, Houston, Texas.
Annual meeting, Galveston, Texas, 1928.

VIRGINIA ROENTGEN RAY CLUB
Secretary, Dr. Wright Clarkson, 205 S. Sycamore St., Petersburg, Va.
Annual meeting Oct. 17, 1928.

British Empire

BRITISH RÖNTGEN SOCIETY
Meets on the first Tuesday of each month from November to June inclusive, at 8.15 P.M., at the British Institute of Radiology, 32 Welbeck St., London; W. 1.

BRITISH INSTITUTE OF RADIOLOGY
Secretary, Dr. John Muir, 32 Welbeck St., London, W. 1.
Meets at 32 Welbeck St., but regular dates and times of meeting have not yet been arranged.

ELECTRO-THERAPEUTIC SECTION OF THE ROYAL SOCIETY OF MEDICINE (CONFINED TO MEDICAL MEMBERS)
Meets on the third Friday of each month during the winter at 8.30 P.M. at the Royal Society of Medicine, 1 Wimpole St., London, W. 1.

RADIOLOGICAL SECTION, AUSTRALASIAN MEDICAL CONGRESS
Secretary, Dr. C. A. Anderson, The Hospital, Dunedin.

* Secretaries of societies not here listed are requested to send the necessary information to the editor.

RADIOLOGICAL SECTION OF THE VICTORIAN BRANCH OF THE BRITISH MEDICAL ASSOCIATION
Secretary, Dr. Colin Macdonald, Lister House, 61 Collins St., Melbourne, Australia.
Meets monthly at Melbourne during the winter.

SECTION ON RADIOLOGY, CANADIAN MEDICAL ASSOCIATION
Secretary, Dr. A. H. Rolph, 160 St. George St., Toronto, Ont.
Next annual meeting, Charlottetown, P. E. I., June 21–23, 1928.

RADIOLOGICAL SECTION, NEW ZEALAND BRITISH MEDICAL ASSOCIATION
Secretary, Dr. P. C. Fenwick, The Hospital, Christchurch.
Meets annually.

CONTINENTAL EUROPE

BELGIAN SOCIETY OF ROENTGENOLOGY
Secretary, Dr. J. Boine, Avenue des Alliés, 134, Louvain (Belgium).
Meets monthly on second Sunday at d'Egmonds Palace, Brussels, except in the summertime.

SOCIETE DE RADIOLOGIE MÉDICALE DE FRANCE
Meets monthly on second Tuesday, except during months of August and September, 12 Rue de Seine, Paris.

SOCIETE FRANCAISE D'ELECTROTHÉRAPIE ET DE RADIOLOGIE MÉDICALE
Meets monthly on fourth Tuesday, except during months of August and September, 12 Rue de Seine, Paris.

ASSOCIATION OF GERMAN ROENTGENOLOGISTS AND RADIOLOGISTS IN CZECHO-SLOVAKIA
Secretary, Dr. Walter Altschul, German University, Prague, II/52.

DEUTSCHE RÖNTGEN-GESELLSCHAFT (GESELLSCHAFT FÜR RÖNTGENKUNDE UND STRAHLENFORSCHUNG)
Meets annually in April, alternating one year in Berlin, one year in some other German city. Meets in addition every two years with the Gesellschaft deutscher Naturforscher und Aerzte.
Permanent secretary, Professor Dr. Haenisch, Klopstockstrasse 10, Hamburg, Germany.
Next meeting with the Gesellschaft deutscher Naturforscher und Aerzte will be in Hamburg, Sept. 16–21, 1928.

SUD- UND WESTDEUTSCHE RÖNTGENGESELLSCHAFT
Meets annually in different cities.

NORD- UND OSTDEUTSCHE RÖNTGENGESELLSCHAFT
Meets annually in different cities.

DUTCH SOCIETY OF ELECTROLOGY AND ROENTGENOLOGY
Holds two meetings a year in Amsterdam, one in the Spring, and one in the Fall.

SOCIETA ITALIANA RADIOLOGIA MEDICA
Secretary, Professor M. Ponzio, University of Turin, Turin.

ALL-RUSSIAN ROENTGEN RAY ASSOCIATION, LENINGRAD, USSR in the State Institute of Roentgenology and Radiology, 6 Roentgen St.
Secretaries, Drs S. A. Reinberg and S. G. Simonson.
Meets annually.
Fifth Annual Meeting in Kiev, Ukraine, May, 1928.

LENINGRAD ROENTGEN RAY SOCIETY
Secretaries, Drs. S. G. Simonson and G. A. Gusterin.
Meets monthly on the first Monday at 8 o'clock in the State Institute of Roentgenology and Radiology, Leningrad.

MOSCOW ROENTGEN RAY SOCIETY
Secretaries, Drs. L. L. Holst, A. W. Ssamygin and S. T. Konobejevsky.
Meets monthly on the first Monday at 8 o'clock, the place of meeting being selected by the Society.

POLISH SOCIETY OF RADIOLOGY
Secretary, Dr. A. Elektorowicz, 19 Hoza St., Warsaw.
Meets annually.

WARSAW SECTION, POLISH SOCIETY OF RADIOLOGY
Secretary, Dr. B. Krynski, 11 Zielna St.
Meets once a month except in the summertime.

SCANDINAVIAN ROENTGEN SOCIETIES
The Scandinavian roentgen societies have formed a joint association called the Northern Association for Medical Radiology, meeting every second year in the different countries belonging to the Association. Each of the following societies, with the exception of the Denmark Society, meets every second month except in the summertime:

SOCIETY OF MEDICAL RADIOLOGY OF SWEDEN
Meets in Stockholm.

SOCIETY OF MEDICAL RADIOLOGY IN NORWAY
Meets in Oslo.

SOCIETY OF MEDICAL RADIOLOGY IN DENMARK
Secretary, Dr. H. Scheuermann, Copenhagen
Meets on the second Wednesday of each month from October to July in Copenhagen, at 8 o'clock in the State Institute of Roentgenology.

SOCIETY OF MEDICAL RADIOLOGY IN FINLAND
Meets in Helsingfors.

VIENNA SOCIETY OF ROENTGENOLOGY
Secretary, Professor Holzknecht, Vienna, IX, General Hospital.
Meets on the first Tuesday of each month from October to July.

CLINICAL MEETING FOR ROENTGENOLOGISTS

PHILADELPHIA, PA., JANUARY 27–28, 1928

This meeting was the outgrowth of a series of complimentary meetings which started with the New England Roentgen Ray Society at Boston in 1926 and was continued by the New York Roentgen Society in 1927. At the latter meeting a continuance committee was appointed and through this committee the invitation of the Philadelphia Roentgen Ray Society was extended.

The meeting began with an inspection of the roentgen-ray department at the Pennsylvania Hospital at 9 A.M. The clinical program was opened promptly at 10 A.M. in the Pennsylvania Hospital amphitheatre, the first speaker being Dr. Walter C. Barker who demonstrated by films "A Technique for Kidney Pro-

jection on Roentgenograms." Dr. Barker stressed the necessity for thoroughly cleansing the gastrointestinal tract and immobilizing the patient during the exposure of the film, and also emphasized the necessity for instructing the patient how to suspend respiration. The main point in projecting the rays is to so tilt the tube that the central ray will pass through the body on a plane parallel with and along the undersurface of the liver. Any suitable exposure factors may be used, but when currents of high milliamperage are used in slender subjects, the lower pole of the kidney is blotted out by over-exposure while the upper pole is properly developed; he therefore recommended a technique using a low milliamperage, preferably 10 ma., in adults weighing 90 to 130 pounds. In heavier patients, currents of higher milliamperage are used, preferably 100 ma., which increases the contrast and thereby outlines the whole kidney shadow.

Mr. James L. Weatherwax, physicist to several of the Philadelphia hospitals demonstrated a projector adapted to the sketching of cross section anatomy charts to the actual size of a given patient. This has been described in substance in this Journal (February, 1926, xv, 169).

Dr. Paul A. Bishop demonstrated "A Device to Assist in the Computation of Total or Saturation Dosage from a Standard Curve;" also "A Film or Cassette Changer for Roentgen-Ray Stereography for Simultaneous Viewing in Two or More Planes"—two exposures upon each of two films. These will be described in detail in a later number of the Journal.

Dr. David R. Bowen demonstrated "A Method of Handling Bed-ridden Patients." The patient is lifted upward from his bed upon a sheet or blanket held by four attendants while a fifth places under him a canvas top stretcher. The stretcher and carriage are used for other purposes which have been described in the Journal.

Dr. Bowen presented lantern slides of two cases of "Aerophagia" and stressed the point that gulping and then belching of the gulped air is the chief and often the only abnormality of these patients. It can usually be readily evoked by encouraging the patient to try to rid his stomach of the "gas," at the same time watching the decrease of the "magenblase." Recognition is easy and important and the condition should always be suspected whenever the principal subjective sign is "gas."

At this point Dr. Bowen announced that other material prepared by the Roentgen-Ray Department had been displaced when it was found that there were in the hospital two patients with acute massive atelectasis (massive collapse) of the lung and a third patient with a lung condition exhibiting in a striking manner some of the signs of this condition.

SYMPOSIUM ON MASSIVE ATELECTASIS

Introducing the subject, Dr. Bowen presented upon a blackboard the following table:

ROENTGEN SIGNS OF MASSIVE ATELECTASIS (COLLAPSE) OF THE LUNG

Affected Lung		Opposite Lung
Increased	1. Density	Decreased
Displaced toward	2. Heart and trachea	Displaced from
Elevated	3. Diaphragm	Depressed
Decreased	4. Intercostal spaces	Increased
Decreased	5. Phrenic and costal excursion	Increased
Curved toward	6. Vertebral column	Curved from

Signs from 2 to 5, inclusive, (sometimes No. 1) are accentuated by inspiration and lessened by expiration; in other words, a pendulum-like excursion of the heart with respiration. Entire absence of this feature should cause a search for complications or a new diagnosis. The return of heart and trachea toward a normal position is the earliest sign of recovery, and the position of these organs continues as the best single sign of improvement or relapse. History is often of great importance. The deformities following empyema, tuberculosis and many other conditions present some of the signs of acute massive collapse. The above table is applicable also to the findings in any acute atelectasis. The condition is common with foreign bodies, infectious diseases and other causes.

Clinical Aspect of Massive Atelectasis. Dr. W. E. Lee, of the Pennsylvania Hospital surgical staff, speaking of the clinical aspect, said that atelectasis (a better term than massive collapse) is found as a congenital lesion, occurring spontaneously, in bronchial

and pulmonary infections; in non-penetrating wounds of the thorax, abdomen and lower extremities; in increased intra-abdominal pressure, as in tumors, distentions and effusions; in postures resulting in immobilization of the thorax or abdomen; in nasal and pharyngeal diphtheria, as described by Pasteur in 1908; in foreign bodies in the trachea and bronchi; following operations upon the abdominal wall, intra-abdominal organs, genitalia and lower extremities.

There are three types: (1) massive, involving more than one lobe on one side; (2) lobar, involving only one lobe, and (3) lobular, involving portions of one or more lobes. The massive type is often diagnosed pleural effusion, the lobar as lobar pneumonia, while the lobular is mistaken for bronchopneumonia. It is probable that more than 70 per cent of the so-called postoperative and postanesthetic pneumonias are some form of atelectasis.

Dr. Bowen's table of roentgen-ray signs, given above, contains all that may be said of physical signs at this time.

Etiology. The etiology is still in dispute. We feel that there are at least two constant factors, one a thick, viscid stream of bronchial secretion which blocks completely the lumen of a portion of the bronchial tree and the air imprisoned distal to this obstruction is absorbed by the pulmonary circulation, the lung then shriveling like a sponge. The second factor is the absence of coughing, either by the inhibition of the cough reflex with drugs such as morphine, or the refusal of the patient to cough because of the pain associated with abdominal incisions and intra-abdominal operations, or interference with the diaphragmatic movements by increased intra-abdominal pressure. The fact that we have been able to reproduce this phenomenon by taking the bronchial secretion from a case of atelectasis in a human and injecting it into the bronchus of a dog, opens a field of research which we hope will result in the demonstration of its true etiology.

Bronchoscopic Observations of Postoperative Obstructive Atelectasis. By Gabriel Tucker, M.D.

Atelectasis of the lung may occur in two ways. First, pressure from without, deflating the lung, the air escaping through the bronchial tree as in pneumothorax, hydrothorax, etc.; and second, by complete obstruction of the bronchi, cutting off the air supply from an area of lung, the contained air being absorbed by the blood. The vacuum is satisfied by displacement of the mediastinum and diaphragm toward the unyielding chest wall, covering the area of lung.

Bronchoscopically in the first, or compression type of collapse the larger bronchi are collapsed, as well as the alveolar portion of the lung.

In the second or obstructive type of atelectasis the bronchi are observed bronchoscopically to remain widely open to the point of complete obstruction and where the obstructing material is semifluid, as in postoperative atelectasis, the atmospheric pressure tends to force the obstructive material deeper into the bronchus. In postoperative atelectasis, the obstruction occurs in the portion of the tracheobronchial tree distal to the point of complete obstruction as a cast of that portion of the tracheobronchial tree.

The first type of collapse from compression was illustrated by a case in which a tack had perforated the bronchus. Dr. Manges demonstrated roentgenographically a complete compression atelectasis of the right lung. The condition cleared up spontaneously after the bronchoscopic removal of the tack. The bronchi were found compressed on bronchoscopic examination.

The second or obstructive type of atelectasis, was illustrated by the case of a lamp from a whitehead mouth gag aspirated during tonsillectomy in which Dr. Bowen demonstrated roentgenographically obstructive atelectasis of the entire left lung. On bronchoscopic removal of the lamp, the bronchus was found widely opened, and the atelectasis cleared up rapidly.

Another case was shown in which the patient had inspirated a bean and Dr. Pancoast demonstrated roentgenographically atelectasis of the right upper lobe. On bronchoscopic examination the bean was found to block the right upper lobe bronchus and after removal the atelectasis cleared in twenty-four hours.

In Dr. Lee's cases of postoperative collapse, obstructive atelectasis, we have found that the tenacious secretions block the bronchi like casts of that portion of the bronchial tree whether the condition be massive, lobar, or lobular in type. Before the air can enter the deflated portion of the lung, it is necessary to remove the obstruction from the tributary and branch bronchi. The mechanical removal of this secretion by bronchoscopic aspiration offers a positive and efficient means of aiding the impaired cough mechanism as well as stimulating cough and mechanically assisting in reinflating the lung.

Presentation of Cases of Massive Atelectasis. Dr. Louis H. Clerf, broncho-

scopist to the Pennsylvania Hospital, presented a patient with postoperative atelectasis from the service of Drs. Mitchell and Lee, showing the value of early bronchoscopy in these cases.

A young man, aged seventeen, was operated on for right inguinal hernia by Dr. W. E. Lee, under gas ether anesthesia. In twenty-four hours, symptoms referable to the chest developed and in forty-two hours after operation, there were signs of a well-developed atelectasis of the entire left lung. The patient was cyanotic, he was restless and anxious, and presented the picture of one seriously ill. A roentgen-ray examination of the chest showed typical collapse of the left lung. Bronchoscopy, performed fifty-two hours after operation and nine hours after the diagnosis of collapse was made, revealed the left bronchus plugged with thick, tenacious secretion. Nine c.c. was aspirated and about 5 c.c. coughed up immediately before and after the bronchoscopy. Within a few minutes after bronchoscopy, examination showed the apex impulse in its normal position. Air freely entered the left lung. The patient experienced remarkable relief and freedom from all his distressing symptoms. He made an uneventful and rapid recovery.

Dr. Alan Parker presented a second case dealing with this condition, this case being from the service of Drs. Gibbon and Billings.

H. N., a German student, aged seventeen, was admitted to the Pennsylvania Hospital with diagnosis of acute appendicitis, acute bronchitis and acute pharyngitis. Chest showed slight dullness at right base, breath sounds distant; and there were asthmatic wheezes throughout the chest. Temp. 100.4°; W. B. C. 12,000; urine negative. Temperature became normal in twenty-four hours and throat and chest were negative on the fifth day. Was operated upon on sixth day, 1.20.28; operative diagnosis was subacute appendicitis. Immediate reaction uneventful. Two days later substernal discomfort, pain in right axilla, slight dyspnea. Temperature 100.6; pulse 120.

Physical examination of chest negative. Seven hours later, evening, increased dyspnea, thoracic pains, small amount of thick, tenacious sputum. Temperature 101.4; pulse 130.

Examination of chest showed diminished expansion, right side, with dullness and tubular breathing; few coarse râles. Heart displaced toward right. Roentgen-ray examination was typical of massive atelectasis. Patient instructed to lie on opposite side. In twenty-four hours patient more comfortable; less displacement of heart as shown by physical and roentgen examinations. Expectoration increased, thick, mucopurulent. From this day patient continued to improve, with signs gradually diminishing and, now, five days after onset, they and the roentgen findings are practically normal.

Dr. Elmer Funk presented a patient from the service of Prof. McCrae, giving the following history:

A colored male, waiter, aged forty-two. Only previous illness was "pneumonia and pleurisy," 1916. In bed eight weeks, no pleural puncture. Patient believed his recovery complete and has had no later illness. Admitted at evening eight days ago after five days' illness beginning with a chill. Chills recurred every evening but patient kept about by day in spite of increasing weakness and dyspnea.

On admission had marked dyspnea with moderate cough and expectoration. Heart was displaced to left with left side of thorax dull and right side hyper-resonant. Receiving ward diagnosis was "massive collapse of left lung." Emergency roentgenoscopy confirmed physical findings but did not reveal characteristic respiratory excursion of the heart. A film developed later showed also multiple cavities. The dyspnea lessened overnight and a mucopurulent sputum developed, amounting to 60 c.c., increasing to 115 c.c. the next day and continuing at the latter amount. Repeated sputum examinations have been negative for tubercle bacilli.

The chief interest of this case for this symposium lies in the fact that on admission the patient exhibited several signs of massive atelectasis, both physical and roentgen-ray, lacking, however, the characteristic respiratory heart excursion. Our provisional clinical opinion of this rather unusual patient is that he suffers from an acute respiratory infection, probably non-tuberculous, possibly an atypical pneumonia in a lung previously damaged and the seat of fibrosis with retraction.

Demonstration of Films after Production of Experimental Massive Atelectasis. By Dr. E. P. Pendergrass.

Two groups of films were shown: (*a*) Before and after production of experimental massive atelectasis of the right lung, the material injected into the lung being from a patient who had massive atelectasis following an operation, and (*b*) films demonstrating massive atelectasis of the right lung following the

introduction of a colloidal material which had the same viscosity as the material removed from patients suffering from massive atelectasis.

In both of these groups the following were shown:

(*a*) Films made before introduction of material into the bronchus.

(*b*) Films made shortly after the introduction demonstrating the massive atelectasis and the deviation of the heart toward the affected side, and films made of the lungs after bronchoscopic drainage demonstrating the efficacy of this procedure in massive atelectasis in that the heart returned to its normal position.

Films were made in the anteroposterior direction during inspiration and expiration, and also lateral films, the right side of the chest being next to the films.

The roentgenological contribution to this work was merely the exposing of the films and interpretation. The credit for the work is due primarily to the efforts of Drs. Lee, Tucker, and Raydin. The work was carried out in the department of research surgery, at the University of Pennsylvania. Probably one of the greatest factors in being able to produce the atelectasis experimentally was due to the fact that Dr. Raydin suggested and used sodium amytal which greatly lowered the cough reflex and respiratory rate.

PULMONARY TUBERCULOSIS IN CHILDREN—HILUM ARTEFACTS

Dr. F. Maurice McPhedran, roentgenologist to the Henry Phipps Institute, presented this subject. He stated that the characteristic tuberculous lesion of young children is basal, with involvement of the associated lymph nodes. Such lesions occur either as an irregular network or as a homogeneous, wedge-shaped opacity. The former can usually be readily differentiated from bronchiectasis and from non-tuberculous pneumonia by diastolic exposures. The latter are distinguished from non-tuberculous pneumonia by their onset with trivial symptoms, and by their characteristic slow clearing from the periphery. Apart from fatal infantile tuberculosis, uncalcified caseous lymph nodes large enough to be recorded roentgenographically do not occur, except in colored children.

Dr. McPhedran's remarks were illustrated by an unusually brilliant series of films.

PRACTICAL UROGRAPHY

Dr. Leon Herman, urologist to the Pennsylvania and the Methodist hospitals, speaking on the above subject stressed the importance of co-operation between the urologist and the roentgenologist in the interpretation of the cystoscopic and pyelographic findings in surgical lesions of the upper urinary tract. Illustrative plates were shown including one presenting the characteristic picture of early tuberculosis of the kidney including ulcerative destruction of the apices of the pyramids and minor calyces. Such lesions are almost invariably caused by the tubercle bacillus. This case, however, was one of metastatic suppurative nephritis, the primary lesion being a carbuncle. *Staphylococcus aureus* was recovered in pure culture from the diseased kidney.

The speaker sought to enlist the aid of the roentgenologist in promoting complete urological studies in patients with obscure abdominal pain and negative roentgen findings for stone. He said that a suggestion to the surgeon, if based on the rational interpretation of the clinical history, would be kindly received, and would result in the demonstration of many instances of nephroptosis, ureteral kinks, congenital hydronephrosis and other lesions impossible to diagnose by physical examination. Dr. Herman employs routinely the syringe method for injecting the renal pelvis. He pointed out that this method was dangerous in the early days of pyelography when collargol was used as a medium but is perfectly safe with sodium iodide and other modern media. The capacity of the pelvis to be injected is first measured, using for the purpose normal salt solution, the upper limit of pelvic tolerance being gauged by the rapidity of return flow of the salt solution, and not by the production of pain. The salt solution is removed by aspiration after which a slightly smaller quantity of the pyelographic medium is injected. The fine quality of the pyelograms shown indicates perfection not only in the method of injection but also in the roentgenological technique of Dr. Bowen. In conclusion, the plea was made for the routine use of stereoscopic plates in pyelography. This method is the routine procedure in the Pennsylvania Hospital clinic. By the method, the degree of angulation of ureteral kinks, the rotation of the kidney, the relative position of gallstones and other extra-renal shadows in the pyelogram, of the relative position of stone shadows within the renal parenchyma, and many other conditions can be demonstrated accurately. These various conditions and a series of retroperitoneal extra-renal tumors were shown on the screen.

THORACOPLASTY

Dr. John B. Flick, of the Pennsylvania Hospital surgical staff, presented three cases

of thoracoplasty and showed lantern slides of cases treated by thoracoplasty. He said plastic operations on the chest wall for the purpose of bringing about collapse of the affected side in certain chest conditions had become more or less standardized. The aid of the roentgenologist is indispensable in the selection of these cases and in guiding the surgeon while carrying out surgical measures, which practically always are accomplished in stages.

The first case was one of chronic unilateral pulmonary tuberculosis of the productive type with contraction of the affected side and pulling over of the mediastinal structures. This patient was much benefited by a paravertebral thoracoplasty. The second case was of unilateral bronchiectasis involving all lobes of the right lung. This required extensive rib resection to produce sufficient collapse. Lipiodol had been introduced by Dr. Louis Clerf through a bronchoscope and pneumonograms made by Drs. Manges and Farrell before operation and again a number of months after the final operation. In the first instance, the size and location of the bronchial dilatations were plainly shown. In the second instance, the marked diminution in the size of the bronchiectatic cavities following surgical collapse of that side was quite evident. The patient had been restored from a life of invalidism to a fairly comfortable and useful existence.

The third case was that of a tuberculous empyema perforating the pleura and forming a cold abscess in the soft tissues of the chest wall. This freely communicated with the pleural cavity. Roentgen studies by Drs. Bowen and Bishop after aspiration and air replacement demonstrated clearly the existing condition. This patient was treated by a paravertebral thoracoplasty in two stages, aspirating the chest before each stage. The patient, who appeared to be in excellent condition, was shown. She has not required aspiration since her last operation and is able to do all her own housework except the washing.

These cases illustrated the great possibilities of this operation in cases of advanced pulmonary tuberculosis, which were only recently considered hopeless.

The clinics on Friday afternoon began at the Polyclinic Hospital where they were conducted by Dr. G. E. Pfahler and Dr. B. P. Widmann.

Cases were presented by Dr. Pfahler as follows:

The first patient, P. R. P., aged forty-three, was referred for treatment by Dr. S. Irwin Darnell, Easton, Pa., on Sept. 26, 1927. At that time he had an ulcerating, grayish, granulating cauliflower carcinoma involving the entire right lower alveolar process, infiltrating into the tissue of the right side of the floor of the mouth, with enlarged lymph nodes in the submaxillary region and upper cervical region on the right side. This had been growing since July. On July 23 it was destroyed locally by electrocoagulation, followed at that time by a full dose of roentgen rays. He had no further treatment. The disease recurred, and at the time of our examination, it extended into the lower jaw bone to within 7 mm. of the lower border. It extended below the inferior dental canal and it seemed that we would probably have to sacrifice the right half of the lower jaw on account of this bone involvement. We applied on the inside of the mouth 2,045 mg-hr. of radium, and on the outside, 23,150 mg-hr. by means of radium packs. At the present time all evidence of the disease has disappeared, both locally and in the metastatic areas, and the most remarkable thing is the complete healing of the bone. There is no damage to the mucous membrane in the mouth nor to the skin externally, though at the end of the active treatment there was very definite erythema with desquamation of the surface skin, but no vesicles or any true skin damage. I have seen 4 cases in which the disease had extended from the mucous membrane of the mouth to the bone, and the bone has healed. In some instances, a sequestrum is formed and is thrown off. We did not insert any radium needles. We find that we are using less and less interstitial applications of radium despite the fact that we have a gram of radium and 800 mg. is in the form of needles. It is my opinion that the interstitial application of radium will decrease. Unfortunately, the surface application demands such a heavy total quantity of radium.

The following lessons may be learned from this case: (1) we need not be discouraged by a recurrence; (2) malignant disease can be made to disappear by means of radium without doing damage to the skin or mucous membrane; (3) squamous cell carcinoma that has extended to the bone can, at least at times, be made to heal, and (4) radium seems to me to be definitely more effective than roentgen rays when it can be applied in either sufficient quantity or be brought in reasonably close contact with the tissue to be treated.

The next case, Mr. J. McA., aged seventy, was referred to me on March 29, 1923, by Dr. F. X. Jones, on account of the extensive recurrence of carcinoma, following amputation of the penis, with nodules extending through the left groin. In 1922 he developed an epithe-

lioma of the penis, for which he was treated three months by a wash. He was then supposed to have had some radium applications for six months. On Feb. 15, 1923, he had an amputation of the penis with resection of the glands of the groin on the left side, and with perineal drainage of the bladder. On March 29, 1923, he had extensive nodular infiltration of the left groin, the pubic region and the perineal region, the nodules being approximately the size of a pea. This patient was treated by high voltage roentgen rays over the groin, pubes and peritoneal region, by the saturation method, between March 29 and June 13, 1923. It is now nearly five years since he was referred for treatment and he is entirely free from disease.

This case illustrates: (1) that recurrence following amputation of the penis may grow very rapidly and extensively; in this instance, within six weeks after the operation; (2) that the value of roentgen treatment of these recurrences is very definitely proven; (3) it should serve to teach the profession in general, that if the roentgen ray will cause extensive recurrence to disappear, it is reasonable to assume that it would have prevented these recurrences from taking place, for certainly some cells must have been retained in these tissues following the operation.

The third case, Mrs. M. G., aged thirty-five, was referred on Dec. 8, 1927, with general abdominal carcinoma, originating in an ovarian cyst. This patient had been operated upon on Oct. 21, 1927, by Dr. Rouge to whom I am indebted for the operative notes. One and a half quarts of fluid were removed. Plastic exudate in anterior cul-de-sac embracing bladder and posterior cul-de-sac enclosing rectum, the right ovary being involved in the exudate; left ovary free with plastic exudate on surface. The omentum was a thick mass rolled up under the stomach in upper part of abdomen, thick and granular. Small intestines matted together under omentum; section of omentum was taken for biopsy. The pathological diagnosis was papillary adenocarcinoma of the ovary; omentum, diffuse infiltration of papillary carcinoma.

Upon arrival in Philadelphia, her abdomen was filled with fluid. When this was removed by Dr. Bates, 160 oz. was obtained. One liter of this was irradiated for twenty-four hours by means of radium, and this has been injected three times a week subcutaneously, and high voltage roentgen treatment has been applied over the abdomen. As you know, I have previously reported a series of cases of general abdominal carcinoma in which I obtained good results from radiation treatment alone, some of the cures extending over a period of five years. This associated injection of irradiated ascitic fluid is suggested in a report made by Whitehouse in the *Proceedings of the Royal Society of Medicine*, February, 1927, in which a case was treated and was free from any evidence of disease a year later. We are treating 3 cases in this manner, but are not prepared to draw any conclusions. Up to the present we have seen no results that have not been duplicated in patients treated by radiation alone. This patient, however, has not suffered from these injections. She is undoubtedly improved, even though we were able to palpate definite masses in the abdomen after the removal of the fluid. Recently we have also used for intravenous injections, bismuth in glucose. We have used this in 10 cases in conjunction with irradiation. We have seen no harmful results from these injections but up to the present we have not seen anything that has not been duplicated by irradiation alone.

The next case was presented by Dr. Widmann.

Mr. J. N., aged fifty-six, was referred by Dr. G. Barringer Slifer, with carcinoma of the penis. In July, 1926, a small nodule about 5 mm. in diameter was first recognized on the dorsum of the glans. Three months later he consulted his physician who performed a circumcision. Two months later the nodule had increased in size, had ulcerated and was somewhat indurated; it was about 1.5 × 2 cm. with slightly elevated and indurated borders. A hard fusiform mass in the right inguinal region was clearly definable. A section removed on Oct. 14, 1926, showed a squamous cell carcinoma, type 2 (Broders). For a period of four weeks radium was applied locally to the glans, and high voltage roentgen rays to both inguinal regions to the point of saturation. A total of 250 per cent of an erythema dose was given to the groins and 1400 mg-hr. of radium to the lesion on the glans, with 0.5 mm. silver, 1 mm. brass, and 2 mm. rubber filtration. Within the next two months local evidence of the disease had completely disappeared. The former site of the lesion became soft and smooth so that the general appearance was normal. There was no longer any palpable evidence of disease in the right inguinal region.

About six months after the lesion was apparently completely healed, there was a return of the ulceration which became progressively larger, with associated induration, and a urinary fistula developed in the center of the dorsum of the glans and the ulcer. Pain was intense. Surface applications of radium

did not improve the local condition, and in September, 1927, under local anesthetic, amputation was done at the base of the organ, with the radiotherm, and the stump destroyed by electrodesiccation. This was about a year after beginning treatment and a further saturating series of high voltage roentgen rays was given to both groins, again totaling 250 per cent of an erythema dose. At this date, Feb. 27, 1928, there is no palpable evidence of disease or recurrence. There is no skin damage in spite of the fact that a total radiation of 500 per cent of an erythema was given.

Dr. Pfahler resumed the presentation of cases.

Mrs. B. F., aged sixty-one, was referred on Oct. 26, 1927, by Dr. Stellwell Burns on account of a carcinoma involving the skin of the right cheek, covering an area 6 cm. in diameter, and elevated 1.5 cm. above the level of the skin, with ulcerated center and indurated border. We excised this area by means of the electrothermic method. It was found to be squamous cell carcinoma, type 2. There were no palpable glands but on account of the diagnosis we gave treatment by the saturation method, from Nov. 4 to Nov. 23, keeping the area at the point of saturation for a period of two weeks.

This case illustrates the fact which we have observed quite commonly, that there are many cases of squamous cell carcinoma occurring on the skin of the face. It is the general assumption that epitheliomata about the face are of the basal cell type. However, we have found many cases of squamous cell carcinoma in these skin cases about the face and we have seen metastases resulting therefrom. I am mentioning this so that all carcinomas will be treated thoroughly from the beginning, and I believe it is better if these lesions are controlled by means of microscopic study, but I believe that when such sections are made, and it is possible to destroy the lesion thoroughly, this should be done. When it is not possible, the lesion should receive postoperative irradiation while the microscopic diagnosis is being made, and at times even preliminary irradiation.

The next case, Mrs. L. W., colored, aged fifty-two, was referred to us on Oct. 12, 1925, by Dr. Marie K. Formad. At that time she had a tumor growing in the tissues of the right cheek, involving chiefly the mouth on the inside. At the first visit, we applied a dose of roentgen rays over the cheek, and at the same time made a roentgen examination of the chest. We found an extensive carcinomatous condition throughout both sides of the chest, with almost complete consolidation over the region of the right middle lobe, but not confined to the middle lobe. When she returned at the end of the week, to our surprise the tumor in the cheek had nearly disappeared. We therefore assumed that the tumors in the chest might also be of the radiosensitive type, and we treated the chest extensively as well as continuing the roentgen treatment of the cheek. As a result of this, all evidence of disease disappeared. She returned to her work as a house servant and continued to work for two years. She returned in August, 1927, with masses under both lower jaws, both groins, axilla and recurrence of nodules in the chest. Previously she had refused biopsy but now consented. Specimen was removed from one of the glands in the neck and was reported by Dr. Eugene Case as metastatic melanoma, malignant. Under treatment these tumor masses are gradually disappearing. We cannot tell whether we will succeed finally in eliminating the disease completely or not.

This case is remarkable, first, because it was probably a malignant melanoma from the beginning, and if so, it is the first case of this type in which I have seen extensive metastatic nodules in the chest disappear under radiation treatment. If this assumption is correct, we should receive considerable encouragement and not be so ready to pronounce a case hopeless merely because we find extensive disease inside the chest. We must, however, realize that it is an extremely advanced disease and that there will be almost certain failure. Second, if this was not a malignant melanoma, with metastasis, from the beginning, we can then assume that it was some type of lymphosarcoma with metastasis within the structure of the lungs. I have not seen isolated nodules secondary to lymphosarcoma scattered through the lung tissue, and it is remarkable therefore from that standpoint. Third, if we assume that this was not a malignant melanoma from the beginning, then we must conclude that a tumor that is not a malignant melanoma from the beginning may change to a tumor of this type.

The clinics were continued at the Jefferson Hospital. The following is an abstract of the subject presented by Dr. W. F. Manges:

FOREIGN BODIES IN THE AIR PASSAGES

The subject of foreign bodies in the air passages is important to roentgenologists, not only from the viewpoint of diagnosis and locali-

zation after the patient has been presented for examination following a clinical diagnosis, but there is also the responsibility of making a diagnosis of foreign body when ofttimes it is not even suspected clinically as the cause of prolonged or recurrent attacks of illness referable to the air passages. Within the past few days, we had a child with an open safety pin in the larynx for nearly a year. Comparatively recently we had the case of a little disc in the trachea for approximately three years without its ever having been recognized, and one physician even made the statement that a roentgen examination would not help out in the diagnosis in that particular instance.

Events such as these should encourage roentgenologists to urge early examinations of the chest, regardless of the clinical aspects of the disease. A foreign body of long sojourn always presents a difficult problem in the way of removal and I am convinced that many such cases come to an early end without ever having been recognized because the complications are those of infection and seem to be so easily explained on a clinical basis.

The roentgenologist should always have in mind the possibility of a foreign body when making a chest examination for any cause, and when there is evidence of pathology in the lower half of the chest with no evidence of disease in the upper half, and, especially, if the lesion is limited to the inner posterior portion of either lower lobe, the chances are largely in favor of a foreign body being the cause of the disease. This is the location where the majority of foreign bodies eventually go. Sometimes the foreign bodies are opaque to the roentgen ray and cast definite shadows but just as often they are not opaque, but the diagnosis is just as important.

On previous occasions I have spoken of the roentgen findings in non-opaque foreign bodies; on the present occasion I want to deal more with the opaque variety and demonstrate the important points in the technical phase of the examinations and the important considerations from the viewpoint of localization.

With even the slightest history of aspiration of foreign body, one should examine the entire extent of the air passages. This includes the nose, nasopharynx, pharynx, larynx, trachea, and all of the lung field. One should never make a negative diagnosis of foreign body of any kind unless he has roentgenograms of the best quality of the entire area. The exposures must be made in so short a time that the motion of breathing will not blur the shadows. There must be enough penetration so that superimposed structures, such as the heart and the spine, will not blot out the shadows of possible foreign bodies, and, in the lateral view, one should be able to trace the air column all the way from the nose to the bifurcation of the trachea.

Also examination should be made by means of the roentgenoscope, particularly to make certain of the character of the breathing function on the two sides, since a disturbance in the breathing function may be the only evidence of foreign body. The roentgenoscopic examination is further important in the case of opaque foreign bodies, especially when they are irregular in shape, so that one may be prepared to describe in detail the size, shape, and relation of the foreign body, and perhaps in this way select the best position for making roentgenograms.

Localization. The most important point in this connection is to establish a definite relation between the foreign body and a bronchoscopic landmark. For example, if there is a foreign body in the upper air passages, it is important to tell whether it is in the larynx or above it or below it, or if part of the object is in the larynx and part above or below it. This should be definitely stated. Especially, lower down, localization should be made with relation to the bifurcation of the trachea or with the bronchi of the various lobes. Roentgenographic details should be of such a quality that one can recognize the bronchial distribution. Exposures must always be made in the anteroposterior and lateral views, and in doubtful cases one must differentiate between tracheal foreign bodies and esophageal foreign bodies by means of an opaque mixture passed through the esophagus. I have previously taught that foreign bodies lie edgewise anteroposteriorly in the trachea but with the flat side anteroposteriorly in the esophagus. We have found in the meantime enough exceptions to this rule so that it should never be depended upon for localization. One must describe the size, shape and contour and make special note of the position of projecting edges or points. For instance, in the case of a tack, state whether the point is upward or downward, and, in the case of a safety pin, whether the open end is upward or downward and also as to whether the point is anterior or posterior or to the right or left or disposed in some oblique manner. Measurements can be made with a definite degree of accuracy, providing the films have been exposed from a distance of at least 36 inches and if the shadows of the foreign body are free from evidence of motion, and, further, if the ray is projected in such a manner as to show the maximum diameter or width or length or opening, as in the case of a safety pin. Stereoscopic films help only when they assist

in outlining more clearly the various bronchial branches.

Pathologic Changes. Pathologic changes take place sooner or later, regardless of the nature of the foreign body. One should be able to recognize the important features of such a pathologic process and determine, for instance, whether there are extensive tissue changes or whether there is probably only a considerable quantity of exudate present. For example, dental foreign bodies, as a rule, are associated with early active infectious processes and one usually finds the lung distal to the foreign body literally filled with pus, whereas metallic foreign bodies may remain in the lung for a considerable length of time and produce nothing more than a slight amount of fibrosis, as a result of long-standing irritation, but, eventually, as the bronchial lumen becomes narrowed and drainage is interfered with, a chronic infectious process sets in and then one finds not only exudate, but more or less extensive destruction or change of some kind in the lung tissue.

Multiple Foreign Bodies. In quite a definite percentage of instances, there is more than one foreign body present and these should be recognized before the bronchoscopist makes an effort to remove them. It is also important to make the localization just as near the time of bronchoscopy as possible because a definite percentage of foreign bodies shift from one bronchus to another.

After Removal. After removal of foreign bodies, films must again be made to show the entire air passages, especially below the level of the larynx, or, if they have been located higher, then this region also must be included in the records, not only because it is important to demonstrate that the foreign body has been removed, but because some patients continue to have the belief that the foreign body is there, in spite of the fact that they have been told that it was removed. And then, too, one may find that after one foreign body has been removed, there is a second foreign body that had not been recognized before removal of the first.

In doubtful cases, where there is not a positive shadow and where there may not be a positive history, one should keep the patient under observation and make roentgen examinations frequently of lesions that are located in the lower air passages to determine the effect of treatment, whether it be by way of bronchoscopy or other measures.

Special consideration and thought must be given to the safety pin, and, particularly, the open safety pin, as a foreign body, both in the air passages and in the food passages. They are found in every conceivable location; they follow no rule whatsoever as to progress through either the air or food passages, or as to whether they go forwards or backwards. It is one of the most common foreign bodies in children. As I have mentioned before, one must describe very accurately its location, the manner in which it is placed; its size and opening, and as to whether or not there is a defect in the point or the keeper that might interfere with closure before its removal.

Lantern slides were shown to illustrate the various points mentioned in this abstract.

SYMPOSIUM ON PRIMARY CARCINOMA OF THE BRONCHUS

1. *Medical Aspect.* By Dr. Elmer H. Funk.

Carcinoma of the bronchus is increasing in frequency. The increase is in some measure relative, and the result of more accurate diagnosis; but it is also absolute, as the postmortem incidence of this compared to all other cancers indicates. For instance, Stachelin of Basle reports an incidence of 5 per cent between 1912 and 1924 as compared with 1.7 per cent before 1906. Berblinger of Jena records an increase from 2.2 per cent between 1910 and 1914 as compared with 8.3 per cent between 1920 and 1924.

By far the majority of the carcinomata of the lung are of bronchial origin and the term "bronchial carcinoma" should be used to designate them, the term "pulmonary carcinoma" being reserved for those tumors in which a bronchial origin has been excluded by the most careful clinical and bronchoscopic studies.

In our series of 14 cases (reported in the Oct. 1, 1927, number of the *Journal of the American Medical Association*) there were 10 males and 4 females; and nine-tenths of the patients were over thirty-five years of age. Both the right and the left sides near the bifurcation were about equally the sites of the tumor, though in some instances the involvement was bilateral, and in others it was so near the bifurcation that it was impossible to determine the site of origin.

Clinical Features. The clinical picture varies greatly, depending on the rapidity of growth, the degree of ulceration and obstruction, the pressure on adjacent structures; the occurrence of hemorrhage, effusion, infection and abscess formation, and local and general metastases.

The onset is usually insidious, but may be sudden with a pulmonary hemorrhage, pain n the chest, or symptoms resembling an acute bronchitis. Local symptoms in our cases were

present as follows: cough in 14; expectoration in 12; pain in the chest in 11 and hemorrhage in 8; dyspnea in 8. There is nothing distinctive about any of them. However, it may be said of the expectoration that the "currant jelly sputum" which is said to be characteristic is rarely encountered.

Physical Signs. It is evident that no single picture of these can be given any more than in the case of foreign bodies in the bronchi. In general, the early signs are those of bronchial obstruction, which may be slight or marked; their tendency is to become more pronounced as the obstruction increases.

Expansion is decreased in any degree of obstruction; and vocal fremitus is apt to be lessened. While the percussion note varies, it usually shows dullness, and with complete obstruction it is often flat. The signs vary from day to day. It is important to remember: breath sounds may be heard over a lobe on one day and twenty-four hours later they will be absent. This rapid change should always suggest new-growth.

It is evident that the signs will be influenced by complications; effusion, abscess formation, changing degrees of collapse, and extension to other portions of the lung and to the lymph nodes.

Early in the course the subjective features are not pronounced, there is often weakness, loss of weight or fever. Later the symptoms are similar to those of tuberculosis. Sometimes the complications produce the most prominent features, as cough, fetid expectoration and fever when secondary infection leads to the formation of an abscess.

Extrathoracic Metastases. In our experience, metastases occur late. From the cases recorded in the literature it appears that extrathoracic metastases are recognized antemortem in about one-third of the cases, and are present in about two-thirds at death.

Diagnosis. It is essential to bear in mind, (1) that the condition is a chronic one; (2) that the signs are not suggestive of change in the lung or pleura alone; (3) that the signs vary from day to day; this is true particularly of râles, and (4) and probably most important, that when the signs of obstruction do exist an attempt should be made to determine the cause. One must remember that carcinoma of the bronchi is not rare and that when history, physical signs and roentgen examination fail to reveal the cause of obstructive phenomena a diagnostic bronchoscopy should be performed.

2. *Bronchoscopic Aspect.* By Dr. Louis H. Clerf.

Objective evidence in diagnosis is as important to the bronchoscopist as it is to the roentgenologist. By looking into, instead of through, the patient, the bronchoscopist can inspect the interior of the trachea, the main bronchi with their larger branches, and the orifices of the many subdivisions. This gives information regarding not only the presence of a new-growth occluding the lumen of the airway or compressing its walls, but also data concerning the color of the mucosa, the shape and size of the lumen, the condition of the carina and bronchial spurs, the movement and flexibility of the tracheobronchial tree and the presence of abnormal secretion. It also permits of removal of a portion of an endobronchial growth for histological examination.

In a large group of cases of primary new-growth of the bronchus observed at the bronchoscopic clinic, the roentgen-ray diagnosis was corroborated by bronchoscopy in some; in others, the diagnosis was made by bronchoscopy when there was no definite roentgen-ray evidence of new-growth. In the presence of obscure roentgenographic shadows which cannot be explained by physical examination, diagnostic bronchoscopy is indicated.

3. *Roentgen-ray Aspect.* By Dr. John T. Farrell, Jr.

The roentgen appearance of primary carcinoma of the bronchus varies with the growth and extent of the neoplasm. In contradistinction to other intrathoracic and to some extrabronchial pulmonary neoplasms there is usually nothing distinctive in its appearance.

At its onset, before obstruction determines so many of the later changes, there is no positive evidence of its presence. However, it is quite probable that even in its very early stages, if one were on the lookout for it, he might find a difference in the aeration of the two lungs due to interference with the entrance and exit of air, and a limitation of the diaphragmatic excursion such as we have seen in a recent case of papillomata of the bronchus. In this patient the lung supplied by the involved bronchus was less translucent than its fellow because air could not readily enter; the diaphragm on the affected side had a very limited motion and with inspiration the heart was displaced to this side due to the difference in intrapulmonary pressure between the lungs. After the papillomata were removed at bronchoscopy both lungs filled equally, aeration was the same on the two sides, and the heart and diaphragm showed no derangement of function or position.

Continued growth of the neoplasm leads to changes roentgenographically evident but often misinterpreted. These phenomena are of two varieties: (1) a localized increased density due to the displacement of air in the alveoli

and bronchi by the malignant tissue, and (2) those due to collapse or infection.

The principal direct result of growth—a localized increase in the density of the pulmonary markings in an area normally clear—is readily understood. The appearance is not distinctive, and the process may be confused with a pneumonia or pulmonary suppuration.

Bronchial obstruction when complete leads to absorption of the air distal to the obstruction with subsequent collapse. The signs of collapse—a local increase in density, displacement of the heart and mediastinal organs toward the collapsed portion, and elevation of the diaphragm on this side—occur in varying degrees depending upon the amount of the lung involved in the collapse. There is nothing to distinguish roentgenographically between the collapse of bronchial new-growth and that due to other causes unless evidence of metastasis occurs in another portion of the lung, or in a distant structure. In one of our patients the fifth lumbar vertebra was destroyed by metastasis.

Retention of secretions and lowered resistance of the tissues in the vicinity of the neoplasm often lead to the development of an abscess or a series of abscesses in the malignant lung which cannot be distinguished from those due to other causes.

The recognition of the existence of bronchial carcinoma as an entity will lead to its more frequent diagnosis. There is nothing typical in its appearance. It should be borne in mind that it simulates atypical pneumonia, collapse or pulmonary suppurative processes, and when these and other changes of indeterminate origin occur malignant disease of the bronchus should be carefully considered and excluded.

The Saturday morning session was held at the Philadelphia General Hospital.

SYMPOSIUM ON BRAIN TUMOR

1. Dr. Henry K. Pancoast presented a "Roentgen-Ray Method of Localization of Certain Angle and Acoustic Tumors." A full description of this method will be published in a future number of the Journal.

2. Dr. Francis C. Grant set forth the "Diagnostic Value of the Ventriculogram in the Localization of Brain Tumor." Dr. Grant has already published in the Journal a discussion of ventriculography.

3. "Some Observations on Encephalography." By Dr. Temple Fay.

The value of encephalography is distinct and well recognized within certain limits. The means of withdrawing fluid from the spinal canal and replacing it with air is not new, but the technique has now been evolved with the co-operation of the roentgenologist, so that conditions which could not be demonstrated previously have been clearly brought out.

It must be remembered that spinal fluid originates primarily in the ventricles and 90 per cent of it is absorbed in the Pacchionian bodies at the cortex. It therefore takes the following course: from the lateral ventricle to the third ventricle, thence through the aqueduct of Sylvius to the fourth ventricle where it escapes into the cisterna magna, then progressing around the medulla to the anterior surface of the pons where there is a large reservoir, the cisterna pontis. It then passes through the incisura tentorii opening, reaching the cisterna chiasma in the region of the pituitary. From this point it is dispersed on either side by means of the Sylvian fissure and a large portion directly between the hemispheres over the corpus callosum. The course of the fluid then becomes devious following the sulci between the convolutions, to finally reach the Pacchionian bodies at the vertex where it drains into the longitudinal sinus. It is evident at once that if air replaces the fluid, these spaces may be seen by appropriate roentgen examinations, and in a successful injection, not only the ventricles but the entire surface, as well as the base of the brain may be seen, and any abnormal features detected.

If this method could be employed in every case it would leave little doubt as to the actual condition existing within the cranial cavity where these conditions affect the spinal fluid pathways or spaces, but because of certain mechanical factors the procedure has not been advocated in cases where intracranial pressure is above 20 mm. of mercury, the patient lying upon the side. This arbitrary level has been taken because if pressure above this point is present, there is definite danger from withdrawal of spinal fluid, especially if there is any indication that the lesion lies in the posterior fossa, as we have learned that spinal punctures in these conditions are sometimes followed by a foraminal hernia with the cerebellar hemisphere being pushed down into the spinal canal. With this knowledge, it is therefore expedient that no withdrawal of spinal fluid be undertaken with the pressure above 20 mm., and so far this procedure of encephalography in a large number of cases, has had no fatalities.

It is also at once evident that if there is a block of the ventricles, such as a tumor of the

third ventricle, or an obstructive internal hydrocephalus, no air could reach the ventricular system, and the information gained from an encephalogram would be of negative value. It would also be attended by some danger, as relief of pressure from the spinal canal would permit of expansion of the trapped fluid under pressure in the ventricles and thus predisposes toward a cerebellar hernia. For this reason and in this group of cases encephalography is contraindicated, whereas, where the pressure is above 20 mm. or the posterior fossa region is suspected, or there is evidence or suspicion of an obstructive internal hydrocephalus, a ventriculogram by means of a needle introduced into the ventricles is to be preferred.

Ventriculography is a procedure which requires a skilled neurosurgeon and in order to protect the feasibility of encephalography from the standpoint of diagnosis, it is important that these contraindications be definitely borne in mind.

The information gained from an encephalogram may be of distinct differential diagnosis. In early brain tumors, when the pressure is not above 20 mm., in differential diagnosis between focal epilepsy and idiopathic epilepsy, in degeneration of the cortex, in vascular disease or spastic diplegia, porencephaly, pituitary tumors without pressure, or any cerebral condition which requires a differential diagnosis where the contraindications mentioned above are not present.

The interpretation of the roentgenograms requires careful co-operation between the neurologist, the neurosurgeon and the roentgenologist, and interpretations are only of value where a distinct understanding of the normal pathways has been gained through experience or familiarity with cerebral anatomy.

The procedure is best accomplished in the sitting position, after an initial pressure reading has been made with the patient lying on the side. Fluid is withdrawn slowly and air replaced, always under careful regulation of a spinal manometer, so that at no time will the air introduced increase the pressure above the normal. To obtain a successful injection, from 90 to 120 c.c. of air must be introduced and this usually means that from 100 to 135 c.c. of fluid is removed. It will be found that air expands under a rise of temperature as it is introduced into the spinal canal, so that there should never be introduced a quantity of air equal to the amount of fluid removed, because this will be followed very promptly by increased intracranial pressure and symptoms.

It is advisable to introduce air up to 100 c.c. and only as much air as will maintain the final pressure at the level at which the initial pressure was registered, thus the volume for volume method is dangerous, whereas the pressure for pressure method has proved to be safe and explains the discrepancy of fluid removed and air injected. A manometer connected with the spinal canal must be used at all times to insure safety and accurate pressure observations.

It must be borne in mind that air injection produces severe headache for a period of twenty-four to forty-eight hours. During the procedure the patient may show signs of sweating and rapid pulse. Vomiting occasionally ensues during the early stages of the injection, or after the roentgenograms have been made. Aside from this, no untoward results have been noted and 10 gr. of chloral hydrate has usually been found enough to maintain the patient in a comfortable condition following the air injection. The vomiting ceases within a few minutes after its onset.

The patient should be watched to determine if intracranial pressure becomes evident from four to six hours after the injection, because fluid may be secreted from the ventricles more rapidly than air is absorbed, and in these cases where fall in pulse and respiration indicate pressure, a spinal puncture may have to be done six to eight hours after the air injection. Air usually persists in the ventricles and subarachnoid space for some time after the injection and usually disappears about the third day.

The procedure has been found of distinct value and its clinical application is becoming increasingly widespread.

4. Dr. Eugene P. Pendergrass gave a demonstration of apparatus used in encephalography and ventriculography, a description of which Dr. Pendergrass will publish in a forthcoming number of the Journal.

SYMPOSIUM ON FRIEDLÄNDER'S BACILLUS PNEUMONIA

1. The "Pathology of Friedländer's Bacillus Pneumonia" was taken up by Dr. William P. Belk.

2. The "Roentgen-ray Diagnosis of Friedländer's Bacillus Pneumonia" was presented by Dr. Karl Kornblum. An abstract follows; the paper will be published in full in an early number of the Journal.

Bacillus mucosus capsulatus or Friedländer's bacillus has been known to occasionally cause pneumonia ever since Friedländer announced the discovery of this organism in 1882. Fried-

länder's pneumonia is a rapidly fatal disease presenting no definite clinical course. It is a distinct pathological entity and is characterized by an extensive destruction of lung tissue leading to the formation of multiple abscesses and cavities. There is very little reference in the literature to the roentgen-ray appearance in this disease. We have had the opportunity to study roentgenologically a series of 4 cases from the medical services of the University Hospital. Three of these recovered. By frequent roentgen-ray examinations in these cases we have come to recognize a chronic form of the disease. Roentgenologically the disease presents four distinct stages. The first is the stage of primary bronchopneumonia; the second, the stage of pseudolobar pneumonia; the third, the stage of multiple abscess and cavity formation, and the fourth, the healing stage or stage of fibrosis. The disease, particularly the chronic form, has frequently been mistaken for tuberculosis. Friedländer's pneumonia must also be differentiated from certain cases of influenzal pneumonia. It is possible that bronchiectasis may at times have its origin in a primary Friedländer infection. We believe that the disease is far more common than is generally supposed and that the roentgen ray offers a means for differentiating it from other pulmonary infections.

BONE APPEARANCES IN YAWS

By Henry K. Pancoast, M.D.

Demonstration of cases of scleroderma, leprosy, yaws, and Raynaud's disease and the effect of morphine on gastrointestinal tract.

Scleroderma, when involving the fingers, causes an atrophy of the terminal phalanges with their ultimate disappearance. The same appearance is noticed in Raynaud's disease and leprosy. In the latter condition there is more narrowing of the phalanges as it disappears.

In yaws two types of lesions are seen in the early stage. One is the appearance of old or rounded vacuoles, and the other is a destruction of the cortex, usually without any upbuilding of new bone because the periosteum is destroyed.

As I reported in an article many years ago, morphine has a very definite effect upon the stomach and small intestines of some individuals, and this may confuse the diagnosis if it is not known that the patient received morphine before the examination. An instance is shown in which morphine was given the night before and there was a stasis throughout the entire small bowel. This could be mistaken for a low grade peritonitis. Sometimes there is a contraction of the stomach near the pylorus without retention.

The next subject taken up was "Pyopneumonephrosis and Pneumaturia" by Dr. R. A. Kern. Dr. Kern reviewed the literature on pneumaturia and demonstrated an unusual case of this condition in which so far as clinical and surgical investigation was able to demonstrate, the condition was primary in the kidney and probably due to a gas-forming bacillus.

Dr. J. B. Carnett made a report on the "Bone Metastasis of Carcinoma." He described the permeation theory of Handley and demonstrated several cases.

Dr. Francis C. Grant took up the subject of "Nerve Section for Relief of Pain in Malignant Disease." His discussion of this condition was limited almost entirely to the sectioning of the fifth nerve. Dr. Grant reported the results in over 60 cases. The procedure is of value in the treatment of malignant diseases of the mouth because it relieves pain and increases the patient's resistance in that the patient can eat without discomfort.

Dr. Eugene P. Pendergrass spoke on the "Roentgen-Ray Phenomena in the Diagnosis of Pedunculated Lesions that Prolapse through the Pylorus." This presentation was very much the same as that reported in the April, 1926, issue of the Journal. An additional group of cases were reported, the diagnosis of the above condition having been made in 24 cases. Ten of these patients had been operated upon and the diagnosis confirmed. Seven cases had pedunculated papillomas, 2 cases had prolapsing mucous membrane, and one case had a combination of two conditions. These conditions are important because of the following reasons: (*a*) They are being recognized with increasing frequency; (*b*) the papillomata tend to undergo malignant degeneration and therefore should be diagnosed early; (*c*) both conditions tend to ulcerate and bleed, especially the papillomata, with resulting severe anemia that simulates pernicious anemia; (*d*) the lesions are amenable to surgical treatment.

The next subject presented was "Surgical Aspects of Benign Tumors of the

Stomach" by Dr. E. L. Eliason. An abstract follows:

Benign tumors of the stomach are not so rare as one would be led to believe and this apparent rarity is fast being falsified by the roentgen ray. Analysis of reported cases shows that 20 per cent of the cases are pedunculated and 20 out of a total of 48 were papilloma or polyp. There is much to say as to the etiology of these tumors. We think that a low grade gastritis is the beginning factor, with a resultant hypertrophy of the mucosa. Once this hypertrophy occurs it is gripped and pushed or pulled along by the peristalsis. As the tissue continues to grow it pulls more and more on its base and hence the formation of a loose or redundant mucosa membrane. Later the base is attenuated and a pedicle is formed. These changes often occur at the pyloric end of the stomach and tend to prolapse through the pylorus and act as a ball valve. The symptoms are extremely atypical. Because of their bizarre and variable nature, they are attributed to a neurosis, anemia, etc. They often befog the diagnosis of other gastric lesions such as ulcer, gastric and duodenal, or cancer. In ⁻ of our cases, 2 were diagnosed duodenal ulcer, 2 gastric ulcer, one pernicious anemia, one a polyp and one a carcinoma. One case came to the hospital for diarrhea, having no gastric symptoms. Study revealed three polyps and an achlorhydria. Indigestion of an atypical type should lead the surgeon to suspect the existence of a benign tumor. The mere surgical extragastric examination by the fingers is not sufficient. Often a fullness or bogginess should breed suspicion of redundant mucous membrane, but this may escape notice. Further, a pedunculated tumor may not be found, then again it may be made to slip from duodenum to stomach and the reverse.

Positive or suspected roentgen-ray diagnosis of this lesion warrants a gastrotomy and direct vision using an endoscope if necessary.

The prolapsing tumor or mucous membrane frequently bleeds or becomes ulcerated, resulting in grave anemias frequently diagnosed pernicious in type. Ulceration may occur and degenerations of a carcinomatous type have resulted.

The above facts tend to impress upon us the importance of thorough examination as well as surgical treatment in these cases. The surgical procedure, pyloroplasty, excision of polyp, sleeve resection, gastrojejunostomy, etc., must be adapted to the individual case.

Mr. James Weatherwax presented a "Correlation of Physical and Clinical Factors in Radiation Therapy in a Group of Philadelphia Hospitals." A paper on somewhat this same subject has appeared in a recent number of the Journal.

Dr. Fielding O. Lewis made a report on "Experience in the Treatment of Carcinoma of the Larynx." This was a most unusual demonstration of a number of patients who had had carcinoma of the larynx. Dr. Lewis demonstrated the different types of operative procedure used in this condition in conjunction with irradiation by radium and deep roentgen therapy.

AMERICAN COLLEGE OF RADIOLOGY

The American College of Radiology will hold its annual meeting at Minneapolis, Minnesota. The chancellors will meet on the evening of June 12; the convocation will be held June 13, 1928.

SECOND INTERNATIONAL CONGRESS OF RADIOLOGY

STOCKHOLM, JULY 23–27, 1928

Patron: H. R. H. The Crown-prince of Sweden

President: PROFESSOR DR. GÖSTA FORSSELL

Hon. Secretary-General: DR. A. RENANDER

Hon. Treasurer: AUG. NACHMANSON ESQ.

NOTIFICATION

Programme Notes.

Sections.

The transactions of the congress will be conducted in four different sections:

A. Röntgen Diagnostics.

B. Röntgen- and Radiumtherapy.

C. Radiobiology and Heliotherapy.

D. Radiöphysics and Medical Electrology.

Work will proceed simultaneously in the four sections.

The meetings will be held at *Riksdagsbuset* (House of Parliament).

Papers.

a. *Papers notified.*

203 papers have been notified to be read at the congress, of which

66 pertain to section A,
53 pertain to section B,
45 pertain to section C,
39 pertain to section D.

From *America* a number of papers, excluding the above, have been notified, the titles of which have not yet been communicated.

Within the four sections papers dealing with the same or similar subjects will be arranged into one and the same group. To each group will be allotted a definite period of time. Papers within each group of subjects will commence to be read at the exact hour specified in the programme, independently of whether all papers in the preceding group are through or not.

The meetings will be held at *Riksdagshuset*.

Time for each paper maximum 15 minutes. Discussion: each speaker restricted to 5 minutes.

b. *Papers invited.*

1. By special invitation the following more comprehensive papers will be read at general congressional meetings:

R. Balli (Italy): Röntgen Diagnostics of the Digestive Tract.
H. Holthusen (Germany): Radiobiology.
L. Jaches (U. S. A.): Chest Diagnosis.
R. Knox (England): Röntgentherapy.
Cl. Regaud (France): Radiumtherapy.
A. Reyn (Denmark): Heliotherapy.

These meetings will be held in hall A (*Riksdagshuset*) and the time for each paper is limited to 30 minutes. Discussion: each speaker restricted to 5 minutes.

2. By special invitation the following members have undertaken to read papers on the subject of *instruction and training in medical radiology:*

V. Altschul (Czechoslovakia).
J. Belot (France).
Fr. Bénard Guedes (Portugal).
P. Flemming-Möller (Denmark).
G. Forssell (Sweden).
S. A. Heyerdahl (Norway).
Pr. M. Hickey (America).
G. Holzknecht (Austria).
K. Mayer (Polen).
St. Melville (England).
H. Meyer (Germany).
M. Nemenow (Russia).
F. Perussia (Italy).

Other members invited to read papers on this subject have not yet given any definite reply.

These papers will be read at *Konserthuset* (Concert Hall) in connection with the opening ceremonies.

Each paper will be restricted to 15 minutes and will not be followed by any oral discussion. Written contributions, however, will be accepted for publication in the transactions.

All papers invited will be read at joint meetings.

Publication of the transactions of the congress.

The Executive Committee of the congress has decided to publish *in extenso* after the congress the papers specially invited. The notified papers, on the other hand, will not be published in extenso in the transactions, the Committee having deemed it appropriate to leave it to the individual member to decide where he wishes to publish his paper.

Detailed abstracts of all the papers, except those on instruction and training in medical radiology, will be published in one volume and sent to the members prior to the congress.

Contributions to the discussion following notified papers will not be published.

Papers invited with corresponding contributions to the discussion and the abstracts of all notified papers will be published in 2 volumes as a supplement to Acta Radiologica. One volume will comprise the papers specially invited on chosen subjects in radiology besides the abstracts of all notified papers. The second volume will comprise the papers pertaining in instruction and training in medical radiology. The price of these volumes will be announced later.

Memoranda for members reading papers.

Typewritten manuscripts of the papers invited must be delivered to the Secretary-General latest by July 27, 1928. Abstracts (not exceeding 1 page octavo, about 400 words) should reach the Secretary-General by April 1, 1928 (for U. S. A. and Canada Dr. G. E. Pfahler, Philadelphia, Penn., latest by April 1, 1928).

The abstract should be accompanied by a statement as to where the paper is going

to be published; such statement is intended to be printed with the abstract.

Papers and abstracts not submitted within the stipulated time cannot claim to be issued in the published transactions.

Papers specially invited and all the abstracts should be written in English, French or German.

The Executive Committee wishes to express the hope that members of the congress will also in the reading of papers and in discussions make use of one of these three languages. In case any member should wish to read a paper in any other language, notification to that effect should reach the Secretary-General before April 1, 1928.

Lantern slides.

In all rooms where meetings are held there will be an opportunity of projecting diapositive pictures on the screen. The pictures should be mounted on glass and be of standard size (8.2 × 8.2 cm., 8.5 × 10 cm. or 9 × 12 cm.).

Speakers are requested to arrange all illustrative material (including radiograms, curves, tables, etc.) in the form of diapositive slides.

All slides should be marked with a number in the lower right-hand corner indicating the order, in which they are to be shown. The boxes containing the slides should be marked with the name of the speaker and with the number of the paper as appearing in the volume of summaries.

Should any member wish to make use of any other form of projection or illustrative material, will he please notify us to that effect before the end of April.

The portrait catalogue.

Members whose portraits have not been received by July 1, 1928, cannot reckon on getting them inserted in the portrait catalogue, which will be supplied to the members at the commencement of the congress.

At the back of the portrait the following data should be furnished:

name in full,
title and main appointment,
year of birth and
place of residence.

Accommodation.

Members of the congress are reminded that rooms can be reserved for them through the congress office. Orders for rooms must have reached the office before July 1, 1928.

Membership.

Notification of membership in the congress should be done in writing to the Secretary-General, the membership fee of 40 Swedish Crowns being included. On receiving the notification the Secretary-General sends a membership card by return of post. Send in your notification in good time so that the Committee can see to your comfort.

Medical men and non-medical members of radiological societies are entitled to partake in the congress.

The last day of notifying membership in the congress is July 1, 1928.

Passports.

Attention is drawn to the fact that membership cards are valid as passports in Sweden and on entering and leaving Sweden. In other countries, on the other hand, such cards cannot take the place of passports.

Exhibition.

At the end of the notification time 27 firms had announced their intention of partaking in the radiological exhibition.

In connection with the papers on instruction and training in medical radiology an exhibition is also being arranged of hand- and textbooks as well as current journals in medical radiology.

Receptions.

Monday, July 23, in the evening: members are invited by the Swedish Congress Committee to a reception at the Restaurant "Berns Salonger". Dress: informal.

Wednesday, July 25: Reception by the City of Stockholm at Stadshuset (Town Hall). Dress: evening-dress.

Thursday, July 26: Subscription dinner at the Grand Hotel Royal. Dress: evening-dress.

Ladies' programme.

A special programme for the ladies of the members will be issued at a later date.

Sport.

Opportunities will be afforded members to play golf, tennis, etc. during the days of the congress.

Notification of address.

Members of the congress unable of being reached by post from Sweden at their home residence during the weeks immediately preceding the congress, are requested to forward in good time to the Secretary-General an address to which communications, if any, can be sent.

All postal matters pertaining to the congress should be addressed to:

The Secretary-General, Second International Congress of Radiology,

Sophiahemmet, STOCKHOLM, Sweden.

HIS MAJESTY THE KING WILL RECEIVE THE MEMBERS OF THE CONGRESS AT THE ROYAL PALACE, THE 24th OF JULY.

Stockholm, March 1928.

GÖSTA FORSSELL
President.

AXEL RENANDER
Secretary-General.

BOOK REVIEWS

Books Received Are Acknowledged under Heading: Books Received. This must be regarded as a sufficient return for the courtesy of the sender. Selections will be made for review in the interests of our readers and as space permits.

Lehrbuch der Röntgendiagnostik, mit besonderer Berücksichtigung der Chirurgie. (A Textbook of Roentgen Diagnosis, with Special Attention to Surgery.) By H. R. Schinz, with the collaboration of W. Baensch and E. Friedl. Cloth. Price, 98 Marks. Pp. 1131, with 1722 illustrations and 5 photographic plates. Leipzig: Georg Thieme, 1928.

This massive textbook of over 1100 pages is dedicated to: The Pioneers of Roentgenology, Heinrich Albers-Schönberg, Antoine Béclère, Gösta Forssell, Guido Holzknecht and George E. Pfahler, and comprises a well-rounded treatment of the whole subject of roentgen diagnosis. After each section follows a bibliography covering the subject discussed; and in this connection we find what appears to us a considerable neglect of English literature references in general, and American ones in particular. It may well be that this book is intended exclusively for the German student or roentgenologist to whom the German literature would be most readily available. However, this shortcoming is a serious one since the book has value as a reference work to roentgenologists of all nationalities. A more generous inclusion of the American literature would give a fairer background and would add considerably to the value of the work. Except for this criticism we have nothing but admiration for the monumental compilation performed by the authors and the very attractive example of the bookmaker's art turned out by the publishers. The authors were assisted in some of the sections by contributions from A. Hotz, O. Jüngling, E. Liebmann, E. Looser, and K. Ulrich. There are included 1722 text figures, some of them in colors and also five photographic plates of roentgenograms. The reproductions in all cases are remarkably clear and reveal considerable detail.

The scope of the work may be indicated by the chapter headings. There is an introductory chapter of twenty-two pages in which are discussed the theory of the roentgen picture, general procedure in roentgen diagnosis, and measures for protection against roentgen rays and the electrical current. Under the heading of "Roentgen Examination of the Bones and Joints," the following subjects are discussed: general fundamentals; osteoporosis, Sudeck's bone atrophy; osteosclerosis, periostitis, bone atrophy; bone fractures and healing; inflammatory bone diseases; heterotopic cartilage and bone formations of constitutional origin; bone tumors; intensive systemic diseases of the bones and their sequelae; injuries and diseases of the joints; osseous aseptic epiphyseal necrosis and disturbances of the apophysis (Perthes', Köhler's, Kienböck's, Schlatter's disease); deformities; disturbances during growth and maturity; roentgen diagnosis of the skull, myelography; soft parts and localization of foreign bodies.

Under the heading of "Roentgen Examination of the Thoracic Cavity" the section headings are: normal thorax and pathological thorax. Under the latter are discussed changes in position and form of the trachea due to intra- and extratracheal processes; tracheal and bronchial foreign bodies; bronchial diseases; pulmonary diseases; pleural diseases; roentgen findings after operation on the lung and thoracic wall; diseases of the diaphragm; diseases of the heart and the large vessels; diseases of the mediastinum.

Under the heading "Roentgen Examination of the Digestive Canal" the following are discussed: mouth and thoracic cavities; esophagus; stomach and duodenum. Under the last, we find a discussion of the roentgen picture of a normal stomach, of the normal duodenum, the appearances of ulcers in the stomach and duodenum, carcinoma of the stomach and other gastric tumors, foreign bodies in the stomach and duodenum, stomach changes through extraventricular processes, constitutional and functional changes in the stomach shape, unusual diseases of the stomach and duodenum. The remainder of the chapter contains discussion of the small and large intestine; peculiarities of the juvenile gastrointestinal tract; pneumoperitoneum; diseases of the liver, spleen and pancreas, and diseases of the biliary system.

The final chapter discusses the "Roentgen Examination of the Urinary Organs" under the following headings: technique; normal kidney picture; function of the efferent urinary canals; congenital anomalies, acquired disasese of the urinary system; ureter; bladder; urethra.

B. Cohen.

Cancer Control. Report of an International Symposium held under the auspices of the American Society for the Control of Cancer.

Lake Mohonk, New York, Sept. 20–24, 1926. Cloth. Pp. 336. Chicago. The Surgical Publishing Co., 1927.

The American Society for the Control of Cancer issued invitations in May, 1926, for an international symposium on cancer to be held at Lake Mohonk, New York, Sept. 20–24, 1926. The meeting was organized for the purpose of considering the prevention and cure of cancer from a practical standpoint, and of expressing in concise language the fundamental groundwork of fact and opinion upon which the collective effort now being made in the United States and other countries for the control of cancer should be continued and extended.

The need of bringing about the meeting had arisen from the seriousness of the cancer problem. According to statistics issued by the United States Census Bureau one in every ten adults now living in the United States is destined to die of cancer. Between the ages of 45–65, one in every five deaths among women is due to this disease. Cancer is now a greater menace to adult life than tuberculosis, and its death rate is rapidly increasing.

The symposium was participated in by the leading men of Italy, France, Germany, England, Holland, Belgium, Switzerland, and the United States, who are devoting themselves to the solution of the cancer problem. The meeting was therefore one of the most important ever held in the world on this subject and this official record of the proceedings should be interesting to the entire medical profession.

The first part of the meeting was devoted to papers on the organized cancer movement in each of the countries represented. The various modes of investigation, the amount of work being done and the progress that has been made in each of these countries along all phases of the cancer problem were presented in a most thorough manner. Plans for the continuation of the investigation along with the problems and obstacles to be overcome were also outlined.

Papers were delivered on the value of education in the control of cancer, the various supposed etiological factors, the tissue and racial specificities of cancer, the clinical and practical value of all phases of cancer researches, the mortality and chance of death from and the prevention of cancer, the newspaper publicity in the control of cancer, the relation of the general practitioner to the cancer problem and all phases of diagnosis and treatment.

Wonderful progress has been attained along some phases of cancer investigation during the past few years, but one is struck by the fact that our present knowledge of cancer is but a very minute part of the entire picture. We therefore should encourage all phases of investigation in this work and it is to be hoped that this meeting will become an annual affair, since the only hope for a solution lies in an organized investigation of the subject by the entire world. Most important information should be forthcoming from regular meetings of this nature, at which all progress could be presented and valuable time saved by useless investigation.

Edgar M. McPeak.

BOOKS RECEIVED

Lehrbuch der Röntgendiagnostik, mit besonderer Berucksichtigung der Chirurgie. Edited by H. R. Schinz, with the collaboration of W. Baensch and E. Friedl. Cloth. Price, 98 Marks. Pp. 1131, with 1722 illustrations and 5 photographic plates. Leipzig: Georg Thieme, 1928.

Grenzen des normalen und Anfänge des pathologischen im Röntgenbilde. Von Prof. Dr. Alban Köhler, Facharzt für Röntgenologie in Wiesbaden. Fifth, greatly enlarged edition. Unbound, price 36 Marks; bound, price, 38 Marks. Pp. 582, with 324 illustrations. Leipzig: Georg Thieme, 1928.

Röntgendiagnostik der Erkrankungen innerer Organe in Tabellenform. By Dr. Emmerich Markovits, Leitender Arzt des Röntgenlaboratoriums im Sanatorium auf der Margareteninsel in Budapest, "wissenschaftlicher Mitarbeiter" des Zentral-Röntgeninstitutes des Allgemeinen Krankenhauses in Wien. Unbound, price, 13.50 Marks; bound, price, 15.50 Marks. Pp. 198, with 390 illustrations. Leipzig: Georg Thieme, 1928.

Radiologie, Clinique du tube digestif. Published under the direction of Pierre Duval, J.-Ch. Roux, H. Béclère. I. Estomac et Duodénum. By Pierre Duval, Jean-Charles Roux and Henry Béclère. Cloth. Price, 265 Fr. Pp. 231, with 400 roentgenograms and 432 drawings. Paris: Masson et Cie., 1927.

La Pyéloscopie. By F. Legueu, Professeur de clinique urologique, Chirurgien de l'Hôpital Necker, Bernard Fey, Chef de clinique urologique de la Faculte de Medecine de Paris, and Pierre Truchot, Chef du laboratoire de radiologie de la clinique de l'Hôpital Necker. Paper. Pp. 114, with 36 plates. Paris: Norbert Maloine, 1927.

The Mechanics of the Digestive Tract. By Walter C. Alvarez, M.D., Associate Professor of Medicine, University of Minnesota (The Mayo Foundation). Second edition. Cloth. Pp. 447, with 100 illustrations. New York: Paul B. Hoeber, Inc., 1928.

Handbuch der gesamten Strahlenheilkunde, Biologie, Pathologie und Therapie. Herausgegeben von Prof. Dr. Paul Lazarus, Berlin. In zwei Bänden. Erster Band. 2. Lieferung. Paper. Price, 22.50 Marks. Pp. 226, with 73 illustrations. Munich: J. F. Bergmann, 1927.

Handbuch der Röntgen- und Radiumtherapie. Ein Lehrbuch für Ärzte und Studierende. Von Dr. med. J. Wetterer, Spezialarzt für Haut-, Harnkrankheiten und Strahlentherapie. Band II. Cloth.

Pp. 784, with 161 illustrations. Otto Nemnich Verlag, 1928.

Gli Elementi Fisici e Biologici Della Radioterapia. By Prof. Mario Ponzio, Direttore dell' Instituto Radiologico Mauriziano di Torino. Cloth. Pp. 519, with 91 illustrations. Torino: Unione Tipografico-Editrice Torinese, 1927.

Internationale Radiotherapie. Besprechungswerk auf dem Gebiete der Röntgen-, Curie-, Licht- und Elektrotherapie. Volume II, 1926–1927. Organized and edited by J. Wetterer, M.D., Mannheim. Cloth. Pp. 1072. Darmstadt: L. C. Wittich, 1927.

The World of Atoms. By Arthur Haas, PH.D., Professor of Physics in the University of Vienna. Translated by Horace S. Uhler, PH.D., Associate Professor of Physics, Yale University. Cloth. Price, $3.00. Pp. 139, with 31 illustrations. New York: D. Van Nostrand Co., Inc., 1928.

The Peaks of Medical History: An Outline of the Evolution of Medicine. By Charles L. Dana, A.M., M.D., LL.D., Professor of Nervous Diseases, Cornell University Medical College. Second edition. Cloth. Price, $3.00. Pp. 105, with 43 full-page plates and 16 text illustrations. New York: Paul B. Hoeber, Inc., 1928.

Dental Education in the United States and Canada. A Report to the Carnegie Foundation for the Advancement of Teaching. By William J. Gies, with a preface by Henry S. Pritchett, President of the Foundation. Bulletin No. 19. Paper. Pp. 692. New York: The Carnegie Foundation for the Advancement of Teaching, 1926.

Scientific Reports from the Government Institute for Infectious Diseases. The Tokyo Imperial University. Director: Prof. Mataro Nagayo. For the year 1926. Edited by Dr. Yoneji Miyagawa. Paper. Pp. 651. Volume V. Tokyo: Skirokane-Daimachi.

Muscle Function. By Wilhelmine G. Wright, Boston. Cloth. Pp. 188, with 26 illustrations. New York: Paul B. Hoeber, Inc., 1928.

INTERNATIONAL ABSTRACTS OF ROENTGEN AND RADIUM LITERATURE

ROENTGEN DIAGNOSIS

Apert, E. Bronchial dilatation and cardiodiaphragm triangle shadow; autopsy observations. *Bull. et mém. Soc. méd. d. hôp. de Par.*, 1927, li, 848–850.

The observation made here confirms that reported by others in which roentgenograms made after the intrabronchial injection of lipiodol showed bronchial dilatation and triangle shadow in the cardiodiaphragm angle which was considered as indicating pleurisy posterior to the mediastinum. The patient later died of tuberculosis and at autopsy the findings confirmed the roentgenologic indications.

Bernard, Leon, and Lamy, Maurice. Three cases of bronchiectasis associated with pulmonary sclerosis of a tuberculous nature. *Bull. et mém. Soc. méd. d. hôp. de Par.*, 1927, li, 553–565.

Case reports are given of three patients suffering from bronchiectasis in which the intermittent presence of the tubercle bacillus was observed in the sputum. The tubercle bacillus was not present in sufficient numbers nor consistently enough to warrant a diagnosis of concurrent active tuberculosis, and this is confirmed by the general condition of the patient. Which of these conditions predisposed to the other is not known. It seems logical that dilatation of the bronchia is the primary condition and the tuberculous infection secondary. It is possible that latent tuberculous infections may be so affected by dilatation of the bronchia that the tubercle bacilli will appear in the sputum, and yet a state of active pulmonary tuberculosis will not necessarily exist. This is further proved by the fact that it often was necessary to examine the sputum several times before the presence of the tubercle bacillus could be determined. Tuberculous infection of a more or less obscure nature is indicated, such as pulmonary sclerosis. The existence of such an infection was brought out by the bronchiectasis.

Bezançon, F., Jacquelin, A., and Célice, Jean. Roentgenologic discovery of a lung abscess caused by the pneumococcus. Rapid recovery without special treatment. *Bull. et mém. Soc. méd. d. hôp. de Par.*, 1927, li, 92–94.

This is a case report of a lung abscess which was discovered by means of the roentgenogram. The nature of the symptoms was such that the abscess would have been overlooked without the aid of the roentgenogram, and it was by this means that a rather peculiar condition was clarified. After the abscess had healed without special treatment, the roentgenogram showed a small cavity in the lung tissue proper. Later this cavity disappeared and in its place a small dark spot was shown which was darker than the remainder of the lung. In spite of the abundance of expectoration, the diagnosis could not have been accurately made without the aid of the roentgenogram and the extent of the infected area could not have been determined, and the completeness of the cure followed.

Boyden, Edward A. Gall bladder versus sphincter papillae. *Proc. Soc. Exper. Biol. & Med.*, November, 1927, xxv, 99–100.

An analysis of the contraction curves of the human gall-bladder constructed from cholecystograms taken at short intervals after a meal of egg yolk and cream, indicates that the average gall-bladder discharges approximately three-fourths of its volume in the first half hour after each meal. The sudden discharge of the first two minutes is interpreted as being due to the opening of the sphincter; the interruption of the emptying during the next two minutes to the initial increase in resistance offered by the sphincter to the flow of the bile; and the subsequent "principal discharge" to the contractile force of the gall-bladder which, after slowly getting under way, is able for a time to overcome the growing resistance at the outlet of the common duct. Stimuli other than the ingestion of food may provide the so-called initial response. For instance, when a patient is suddenly subjected to the odor of fried bacon, there ensues a momentary discharge of bladder bile, and in two minutes the gall-bladder begins to fill again in spite of the fact that the patient continues to smell food. The same initial response is elicited when a fasting patient swallows a glass of water, but frequently in this case reduction of the gall-bladder continues twelve to thirty-five minutes after the opening of the sphincter and results in a total discharge of 8 to 13 c.c of bile.

Experimental evidence seems to indicate that the gall-bladder may continue to contract and to inject the entire biliary duct system during antiperistaltic obstruction of the common duct outlet; and that even when the sphincter has been eliminated the gall-bladder may be made to contract by the ingestion of food or by the injection of appropriate drugs. There are times when the resistance at the outlet of the common duct is too great to be overcome by the gall-bladder even though it continues to contract. This suggests that an explanation of individual and sex differences in the emptying time of the gall-bladder may yet have to be sought for in the regulatory action of the sphincter papillae.

Copher, Glover, and Illingworth, C. F. W. Further studies on the emptying of the gall-bladder. *Proc. Soc. Exper. Biol. & Med.*, December, 1927, xxv, 172–173.

In the experiments reported, the gall-bladder of an experimental animal was exposed at operation and filled with iodipin; and twenty-four hours later the animal was recovered sufficiently for experiments on the emptying of the gall-bladder. It was found that if the animal is starved, no emptying of the gall-bladder occurs for two, three or more days. A meal of egg yolk and cream, however, causes a fairly rapid discharge of the iodized oil from the gall-bladder along the common duct into the duodenum. This emptying ceases usually after three or four hours at the end of which time the gall-bladder, in the cat, may be completely empty. More often traces of the iodized oil are left in the gall-bladder and these may remain until a further meal is ingested.

To exclude elasticity and variations of intra-abdominal pressure, iodized oil was placed in the gall-bladder of the cat and a cannula connected with a finger cot was inserted into the cystic duct. This procedure allowed free communication between the gall-bladder and the rubber duct. Twenty-four hours after the operation the gall-bladder was still full, in spite of the fact that elasticity and variations of intra-abdominal pressure had had full play. A fatty meal was given and in five hours a considerable quantity of the iodized oil had passed from the gall-bladder into the rubber bag. This experiment indicates that a part of the emptying process is due to muscular activity of the gall-bladder wall. Other experiments demonstrate that changes of intra-abdominal pressure play a minor rôle in the emptying of the viscus. The authors believe that muscular contraction is not the only factor involved and that elasticity and the ebb and flow of fresh bile from the liver play an important part. The presence of pancreatic juice was found necessary for the fatty meal to cause emptying of the gall-bladder.

Although no one has observed contractions of the common duct in the human, it is of interest that they can be easily observed in the pigeon. They are of definite peristaltic nature, being preceded by a relaxation phase which travels rapidly down the duct. Iodized oil passes from the common duct of the cat even if the hepatic and cystic ducts are ligated. This may possibly be due to muscular contraction.

Dufour, Henri. Two cases of sacralization of the fifth lumbar vertebra with clinical symptoms in the lower limbs and absence of the twelfth rib. *Bull. et mém. Soc. méd. d. hôp. de Par.*, 1927, li, 922–925.

In cases of sacralization of the fifth lumbar vertebra the use of the roentgenogram has in some cases discovered also the absence of the twelfth rib. When a roentgenogram of the entire vertebral column is made, such a condition is readily observed, which would ordinarily have been overlooked. In 2 cases which are reported here, the absence of the twelfth rib was shown by this means. No particular significance is attached to this condition, except that it may have some bearing on the symptoms exhibited in the lower limbs.

Garnier; Cathala; Oumansky, and Chene. Roentgenologic observations in the course of cancer of the lung. *Bull. et mém. Soc. méd. d. hôp. de Par.*, 1927, li, 1318–1323.

Roentgenograms were taken at different periods in the development of a tumor in the lung, the diagnosis of which would otherwise have been impossible without histologic examination. The symptoms were such that a clinical diagnosis was impossible; they consisted primarily of chronic pneumonopathy with abundant muco-purulent expectoration and moderate fever. Examination for the tubercle bacillus was negative. Autopsy showed a primary cancer of the lung which had probably developed because of chronic broncho-pulmonary inflammation or secondary cancerization of an abscess. The roentgenograms would indicate that the cancer had its origin in a pulmonary suppuration. The varying images shown by the roentgenograms were undoubtedly due to the differences in the amount of mucous and pus in the localized area in which the tumor was situated. Two illustrations are given to show this change in

appearance of the cancer in two different exposures. The roentgenogram in this case was a means of diagnosing a rather peculiar condition and also in aiding in determining the direct cause of the cancer observed as well as following the progress of its development.

Goldhamer, Karl. Anatomical-roentgenological contribution to the question of "pelvic spots." *Fortschr. a. d. Geb. d. Röentgenstrahlen*, 1926, xxxv, 435–448.

In a great majority of cases, phleboliths were found to be the cause of "pelvic spots" in circumstances which presented difficulties in differential diagnosis between these "spots" and ureteral stones. There are three types of cases in which a definite differential diagnosis of ureteral stone as against phlebolith is unobtainable under unfavorable clinical or roentgenological conditions with the technique at present available. These are cases in which (1) the introduction of the cystoscope and the visualization of the ureter in the roentgenogram is not possible; (2) the shadow of the phlebolith is not recognizable as a venous stone because of its shape and relative position with respect to the filled ureter; and (3) there is present a double ureter. There will always be cases, although rare, which will not be explained until an autopsy is performed.

There is often the possibility of being able to feel the phleboliths through the vagina or the rectum; and this way, one may be able to separate the phlebolith from the filled ureter in cases in which the shadows of these two structures cannot be projected apart in the roentgenogram.

Harvier, P., and Lemaire, A. Information furnished by the use of lipiodol in arteritis of the lower limbs. *Bull. et mém. Soc. méd. d. hôp. de Par.*, 1927, li, 448–455.

Lipiodol was used by the authors in the study of 14 cases of arteritis. Five cases showed arterial blockage with gangrene; 5 showed only arteritis without gangrene; and 4 had all the clinical evidences but no pathological changes. All the patients were from sixty to eighty years of age. Injections of lipiodol were made directly into the arteries at the rate of 1 c.c. per minute; total injections ranged from 5 to 12 c.c. No serious results were noted, except that in the older patients, due to poor elasticity of the vessel walls, hematoma was observed, but this was quickly resorbed. In one case gangrene developed eight days after injection, but there is no certainty that the lipiodol was responsible for it. None of the reactions from these injections were dangerous.

After these injections, roentgenograms were made and the conditions of the arteries studied. These may be made in series to follow the progress of the lipiodol. The authors do not insist that it will always be possible to obtain satisfactory results, but the method offers a further means of study of arteritis and other similar conditions in the arteries. By this means it is often possible to indicate to the surgeon the advisability for amputation, and information is gained which is possible by no other method, especially in cases of degeneration of the artery.

Ivy, A. C., and Oldberg, Eric. Contraction and evacuation of gall-bladder caused by highly purified "secretin" preparation. *Proc. Soc. Exper. Biol. & Med.*, November, 1927, xxv, 113–115.

The gall-bladder of a dog was filled with lipiodol, using anesthesia and aseptic technique. From twelve to twenty-four hours later, the dog, trained to lie quietly on the table, one dose of a secretin preparation was injected intravenously every ten minutes for one hour, and roentgenograms were made two minutes after each injection. These injections practically empty the gall-bladder in the course of an hour in some dogs, in others, from one-third to one-half of the iodized oil was evacuated. In some of the dogs changes in the contour of the gall-bladder could be seen roentgenoscopically.

In one dog the gall-baldder was visualized by using the tetraiodophenolphthalein technique. An intravenous injection of secretin every ten minutes for one hour caused the gall-bladder shadow to decrease approximately one-fourth in size.

These and other experiments established that a highly purified dilatin-free extract of intestinal mucosa, on intravenous injection, causes the gall-bladder to contract, *i.e.*, to increase its postural tone, and to evacuate. The active principle is either secretin or some substance closely associated with it. The authors have evidence supporting the view that the duodenum plays some rôle in controlling the passage of bile into its lumen.

Laroche, and Huet, J.-A. Stasis of the bile duct shown by means of the tetraiodophenolphthalein test after cholecystectomy. *Bull. et mém. Soc. méd. d. hôp. de Par.*, 1927, li, 889–892.

By means of the roentgenogram after administration of tetraiodophenolphthalein it is possible to observe stasis of the bile duct. Four grams of the sodium salt of tetraiodo-

phenolphthalein are given and four hours later roentgenoscopic examination does not show the tetraiodide in the abdomen. Many plates were made of the dorsoventral position on the Potter-Bucky diaphragm, 40 ma., 3 minutes, and an image obtained which showed an opaque spot in form similar to a shuttle 3 cm. long and 0.5 cm. thick. This was shown to be in the position of the end of the bile duct, almost at the point where it joins to the duodenum. This condition is rare and apparently never before reported as a roentgenologic finding, although it has been reported many times in autopsies. The exact cause is not known, but it may be that pancreatitis is conducive to such a stasis.

Libert, E. and Bariéty, M. Symptoms of iodism following the intrabronchial injection of lipiodol. *Bull. et mém. Soc. méd. d. hôp. de Par.*, 1927, li, 615–616.

The authors report 2 cases of slight intolerance to lipiodol when 40 c.c. of this oil was injected into the bronchial tubes. On the day following injection, both patients presented local edema of the face and neck, and lachrymation. This condition did not last long, having almost entirely disappeared after twenty-four hours. The patients had not previously received injections of lipiodol and it seems that they were especially sensitive to it.

Lortat-Jacob, Belot and Naban. Two cases of sternal localization of a malignant granulomatosis. *Bull. et mém. Soc. méd. d. hôp. de Par.*, 1927, li, 681–687.

Malignant lymphogranulomatosis localized in the sternum is less frequent than Hodgkin's disease, but is not unusual. The authors report 2 such cases which were treated by means of roentgenotherapy, after the diagnosis had been verified histologically after biopsy of a ganglion. Later roentgenograms verified the localization of this granuloma in the sternum. It is shown that the body of the bone retains its normal form and density, but the manubrium is greatly changed. The normal trabeculation has disappeared in large part and in place of the bone there appears to be a pseudo-cavity indicating loss of substance. There was no tendency to necrosis or suppuration, but a tendency toward sclerosis. The roentgenographic picture is not characteristic and does not by itself permit of an accurate diagnosis.

Rist, E., Gally, L., and Soulas, A. Remarks on a case of hemorrhagic bronchiectasis studied roentgenologically after injection of lipiodol into the bronchial tubes. *Bull. et mém. Soc. méd. d. hôp. de Par.*, 1927, li, 159–162.

This case first came to the attention of the authors with hemoptysis of long duration. Examination of the lungs and the history of the patient did not reveal anything of interest or diagnostic importance. Later, after an injury to the right side of the chest sustained in foot-ball, there was a serious recurrence of bloody sputum. The first diagnosis was that of tuberculosis of the left lung. Roentgenograms showed condensation in the upper left lobar region. After a continuation of the hemoptysis over a period of months, in which roentgenograms continued to show involvement of the left lung, lipiodol was injected directly into the bronchial tubes. Roentgenograms then showed typical pictures of bronchiectasis. The hemorrhages were the only symptoms which indicated bronchiectasis, but the roentgenogram showed this condition clearly. The etiology of this condition remains obscure, since there was no history of previous conditions which might have caused it.

Rist, E., Hirschberg, F., Ill. G.-E.-H. and Lapointe-Raulot, J. Left unilateral bronchiectasis associated with stenosis of the right bronchus. Iodide intoxication following two diagnostic injections of lipiodol. *Bull. et mém. Soc. méd. d. hôp. de Par.*, 1927, li, 599–601.

This case is of interest because lipiodol was used to demonstrate a stenosis, probably of congenital origin, which was associated with bronchiectasis of the opposite bronchus, and also because the patient presented an example of intoxication due to the lipiodol. This was of short duration. The use of cocaine with the lipiodol seems to have been responsible in part for this reaction. It is evident also that the two injections of lipiodol were given too close together; the five-day interval between them may be considered too short. Such conditions as this are rare, but they can be prevented and the interval between injections should be increased.

Roubinovitch; Crouzon, O.; Foulon, P., and Gilbert-Dreyfus. Two new isolated cases of craniofacial dysostosis which was not hereditary. *Bull. et mém. Soc. méd. d. hôp. de Par.*, 1927 li, 676–681.

This is a report on 2 cases of craniofacial dysostosis in which the roentgenogram showed a typical picture of this condition. The detailed structures of the bones of the head can be studied more clearly in this way. A reproduc-

tion of such a roentgenogram is given for illustration.

Tapie, Jean and Sorel, R. Bronchiectasis and mediastinal pleurisy. *Bull. et mém. Soc. méd. d. hôp. de Par.*, 1927, li, 1039–1044.

The roentgenogram was used to study the extent of lung involvement in bronchiectasis and mediastinal pleurisy. The image typical of this condition was clearly shown. After intercricothyroid injection of 20 c.c. of lipiodol there was revealed behind the mediastinum a group of bronchial dilatations in the lower right lung. Injection of lipiodol into the air passages was without harm; this is of interest because of the history of the case, which passed through the stages of hemoptysis, pseudotuberculosis, bronchiectasis and mediastinal pleurisy.

Terris, E., Jonesco and Cohen. Ulcer of the leg. Osseous lesions and syphilis. *Bull. et mém. Soc. méd. d. hôp. de Par.*, 1927, li, 1189–1194.

Forty cases of ulcers of the leg are reported with roentgenologic findings. The positions of the ulcers were observed by means of the roentgenogram and statistical data of this information were made possible. In the majority of cases the lesions presented were shown to be periostitis, more rarely osteoperiostitis, and in 3 cases only, true osteitis. Some of these cases were proved to be syphilitic of hereditary origin, while others were not syphilitic. By means of antisyphilitic treatment 68.7 per cent were cured, and the ulcers entirely disappeared. While this paper is chiefly concerned with ulcers of the leg due to syphilis and the results of proper treatment, the use of the roentgenogram in studying the location and extent of the ulcers is considered of value in this study.

ROENTGEN AND RADIUM THERAPY

Ameuille, P., and Tacquet, M. A pleuropulmonary tumor simulating pleural effusion which was sensitive to the roentgen ray. *Bull. et mém. Soc. méd. d. hôp. de Par.*, 1927, li, 1221–1225.

This is a report on the effective use of roentgenotherapy in treating a tumor of the lung. The patient was only thirteen years of age and had suffered from this tumor for a year. Since lung tumors are not ordinarily affected by this treatment, the case is unusual. Six treatments of mild roentgenotherapy gave very marked improvement. The roentgenologic picture shows a condition quite similar to marked pleural effusion and the disappearance of this tumor is also shown in another illustration. The success of this treatment on this particular patient is so unusual that it is of particular interest, especially since ordinary lung tumors are not susceptible to this form of therapy.

Baer, Walter. On the treatment of inflammatory adnexal diseases, especially gonorrhea, with roentgen rays. *Strahlentherapie*, 1926, xxiv, 315–317.

Three procedures are available: (1) permanent roentgen castration; (2) temporary castration; (3) mild irradiations with the so-called "inflammation dose," a procedure employing a dose below the threshold value for inhibition of the ovarian follicular apparatus. Since pelvic inflammations occur largely among young women, the question of permanent castration cannot be considered, and the other two procedures are employed. Septic diseases of the genital adnexa are excluded from roentgen treatment, one reason being that such diseases respond very quickly to hydrotherapeutic measures. Tuberculous infections of the adnexa are treated largely by roentgen therapy. In gonorrheal infections hydrotherapeutic measures are first tried in conjunction with heat and cold treatments, and only when these fail is roentgen therapy resorted to. Early ascending, very acute gonorrheal infections are excluded from roentgen treatment because the hyperemia following irradiation would only accelerate further ascension of the infection. Such cases demand the strictest rest in bed, treatment with ice packs and avoidance of all further irritation.

A comparison was made as to the effects of the treatment of gonorrheal infections by very small doses (8 to 12 per cent of the skin unit dose) and temporary castration dose (26 to 30 per cent of the skin erythema unit). The results seem to favor the heavier dosage. There never appeared an acute recurrence as a direct result of irradiation producing temporary castration. On the other hand, in 5 out of 12 cases this appeared when milder doses were used. This frequent appearance of recurrences in conjunction with menstruations in women who had received the mild roentgen treatments seems to indicate that it is necessary to eliminate ovarian function in order to favor recovery from the infection. The recovery is probably not due primarily to the higher dose.

Bardachzi, Franz. Treatment of leucemia. *Strahlentherapie*, 1927, xxiv, 741–744.

The unsatisfactory results hitherto obtained

in the roentgen treatment of leucemia may be explained largely by unsuitable procedure. Failures have been due to under-dosage, the use of soft rays producing skin injuries and preventing continued treatment, and nowadays over-dosage with hard rays accompanied by undesired reactions. The use of large doses is regarded as dangerous and unnecessary. For the treatment of myeloid leucemia a slow careful roentgen therapy is recommended. This includes gradual irradiation of the whole splenic area through different fields with the smallest effective doses of well-filtered rays, together with systematic irradiation of the bones. In cases of lymphatic leucemia raditions are systematically administered to the gland swellings as well as to the spleen.

The spleen area is divided into fields 10 × 15 cm. In order to protect the skin, the exposure begins with one of the lower fields which receives an experimental dose of 10 Fürstenau units (at 200 kv., filtration through 0.5 mm. Zn plus 1 mm. Al, the author's skin erythema dose equals 180 F units). If no reaction occurs, this dose is increased after two days, but if it is sufficient the other fields receive similar doses. The subsequent plan of irradiation follows the Holzknecht scheme except that the time is extended considerably. After exposure of the second spleen field, irradiations of the bones are given in the next few days in the cases of myeloid leucemia, and in lymphatic leucemia the gland irradiations are begun. After seven days a further spleen treatment is given. The scheme of treatment is not rigid but depends on the individual case. Great care should be taken with irradiations in the region of the liver. As a rule the above treatment results in a desired effect within about eight weeks. Toward the end of the radiation treatment the intervening pauses are extended and the doses are decreased in order to produce a very gradual decrease in leucocytes and the production of a leucopenia is painstakingly avoided. This terminal effect is attained by avoiding further spleen treatments and depending upon irradiations of the bones.

Bucky, Gustav. Fundamentals and prospects of "grenz" ray therapy. *Strahlentherapie*, 1927, xxiv, 524–533.

There is reason to believe that radiations lying between the short ultraviolet rays and the ordinary rays may have unique therapeutic properties. Certain biological effects have been observed with the "grenz" radiations (roentgen rays of about 2 Å wave length) which may prove of considerable utility. The explanation of these effects is still the subject of speculation. One might assume a selective effect of the various wave lengths. It may also be that the penetration of these rays is similar to that of the ultraviolet and that effects are produced at comparable depths below the surface.

A comparison of the characteristics of ultraviolet, "grenz" and roentgen radiations is shown in the following table:

		U. V.	"Grenz"	*X*-rays
Erythema	Latency	several hours	0–5 wks.	days to weeks
	Local temperature rise	+	−	+
	Duration	about 1 wk.	many weeks	several weeks
	Sensation	+	−	++
Epilation		−	−	+
Blistering		++	+	++
Ulceration		−	+	+++
Sequelae	Pigmentation	++	++	+
	Telangiectasis	−	−	+
	Atrophy	−	−	+
	Scaling	++	+	−
	Restitution	+	+	−
Leucocyte drop		−	+	−

A plea is made for further investigation of the effects of these rays in order that their true value may be established.

Flaskamp, Wilhelm. The question of injury to offspring by roentgen rays. *Strahlentherapie*, 1926, xxiv, 282–287.

The views of Wintz of the Erlangen clinic appear to have been confirmed by the recent report of Martius and Nürnberger. The irradiated ovary, after cessation of amenorrhea, is believed to return to complete function. The attitude taken at the Erlangen Clinic is that there exists a fundamental difference in the effect of radiation upon the ripe ovum and the unripe Graafian follicle which still has before it the whole developmental cycle. The irradiation technique for temporary sterilization is difficult and demands, in addition to the best equipment and measuring instruments, also considerable experience. Hence, it should be practised only by the expert.

In the Erlangen Clinic this is carried out carefully only in selected cases of acute inflammatory pelvic conditions when there is definite evidence that menstruation interferes with the recovery process. The treatment is denied as a general therapeutic measure or as a contraceptive method. In the interval between irradiation and occurrence of amenorrhea, conception should be avoided or if it has occurred pregnancy should be interrupted

because in this stage the fertilization of an injured ovum is a very definite possibility. Emphasis is placed on the fact that irradiation of the ovary in the female is no longer a hazy field for speculation but has become clearly outlined by practical experience.

Halberstaedter, L. Intratumoral treatment. *Strahlentherapie*, 1926, xxiv, 253–267.

The introduction of bare thorium x of about 0.5 mc. produces a necrosis for a radius of 1.5 mm., and around this, cell injury and round cell infiltration extending 3 to 4 mm. outward, or more depending on the radiosensitiveness of the tissue. With bare thorium x rod 1 cm. long and of 0.5 mc. strength about 1 c.c. of tumor is adequately destroyed. For satisfactory therapy the thorium should be distributed throughout the whole tumor so as not to miss any portion. Consequently the tumors suitable for satisfactory treatment by bare rods and capillaries are those of relatively limited extent and so located as to be readily palpated by the fingers and completely delimited. This includes primarily the group of external tumors such as those on the lips, tongue, tonsils, nasopharyngeal surface, and the smaller cancers of the breast, especially in males. The experience of the author with these tumors is illustrated in a series of pictures. In the case of larger tumors or undesirable necrosis of the tongue, for instance, the thorium x is filtered with gold or even platinum of 0.5 mm. thickness. These filters have the disadvantage of greater size and the necessity of subsequent removal. The applicability of intratumoral treatment is limited. Combination with other modes of treatment is not discussed in this paper, but it is a valuable procedure in many cases. Moreover, surgical exposure permits subsequent application of the intratumoral technique with satisfactory results. An opinion as to the value of this method as regards permanent cure can be had only after the collection of sufficient statistics.

Hamperl, H., and Schwarz, G. The more precise determination of the roentgen effect upon cancerous growths. *Strahlentherapie*, 1927, xxiv, 607–659.

An extensive and detailed report is given of a case of basal cell carcinoma of the skin treated apparently successfully with roentgen rays. The case occurred in a woman aged seventy-five, who at the time of admission presented an extensive tumor on the right side of the face extending from the nose almost half way across the cheek and from the lower eyelid almost to the mouth. Between the first and second treatments the tumor showed a decided decrease in size. The second treatment was given thirty-six days after the first and there resulted a definite superficial sloughing process, the tumor decreasing still further in size. Following this the major portion of the tumor grew smaller and smaller, but a few nodules near the base of the nose persisted until several large doses of roentgen rays were applied. A small recurrent nodule appeared about a year after the beginning of treatment and it disappeared promptly after roentgenization.

An extensive study of the histological changes was made. Apparently the effect of the roentgen rays as disclosed in the microscopic sections was exerted primarily on the epithelial portions of the tumor, on the one hand, in the form of acceleration of regressive changes (hydropic degeneration, vacuolar degeneration, necrosis, etc.), and on the other hand, in a differentiation of the tumor cells to cornifying squamous epithelium, a process which might possibly be included in the group of regressive changes (corresponding to the "keratoid degeneration" of Krompecher). So far as could be determined there seemed to be no effect of the roentgen rays toward destruction of the lymphocytic and leucocytic elements in the stroma either in the early or late stages.

In the present case the primary effect of the roentgen rays, the production of a mitosis-free interval and the secondary effect all conformed to the Alberti-Politzer rules. The primary effect appeared to last about two hours. The mitosis-free interval was unusually long in comparison with that found in embryonal tissue, and the secondary effect occurred very late. A new irradiation during the interval of practical freedom from mitoses was not without effect and caused renewed regression of the tumor. The radioresistant portion of the tumor was found at the periphery and corresponds probably to the youngest portion. Morphologically it is hardly to be distinguished from the rest of the tumor apart from the increase in mitoses which may be regarded as evidence of rapid recovery from a temporary roentgen injury. The general applicability of the belief that roentgen sensitiveness of carcinoma is directly proportional to the number of mitoses is denied so far as this carefully studied case is concerned.

Heimann, Fritz. Mild irradiation of the ovaries, and pregnancy. *Strahlentherapie*, 1927, xxiv, 733–735.

A report is given of a case which is believed to be the first one recorded in which the

human ovary receiving mild doses of roentgen rays showed definitely that no microscopic changes occur.

Amongst many dozens of cases which the author has treated with mild doses of roentgen rays for correcting amenorrhea, about one-third failed to show any response. The technique of treatment remained the same and the cause for these failures is unknown. In about 66 per cent of the cases menstruation appeared after a shorter or longer interval and has reappeared regularly ever since. In 2 cases, three and four months after the return of menstruation, there occurred conception resulting in normal births of healthy infants. These cases are briefly cited.

Heinismann, J. I., and Czerny, L. J. Roentgen therapy of tumors of the hypophysis. *Strablentherapie*, 1926, xxiv, 331–335.

The experience of the authors indicates a favorable verdict regarding the effectiveness of roentgen therapy on hypophyseal tumors. The acromegalic forms responded better, and this is ascribed to the histological structure of such tumors. According to Fischer and Biedl most of these cases are adenomas. This fact was also demonstrated experimentally by Strauss who found in rabbits after irradiation of the hypophysis a decrease in colloid content. Observations on the ophthalmic and adiposo-genital types indicate that the less favorable results are most probably to be explained on the basis of difference in histological structure of the tumors. The encouraging results obtained in these cases, taking into consideration the anamnesis and the clinical features, lead to the assumption that they are not mere remissions of the disease such as are so frequent in cases of tumor of the hypophysis.

All of the cases observed by the authors were of the pronounced progressive type. The roentgen treatment was individualized in accordance with the symptoms of intracranial pressure: headache, dizziness, vomiting, general weakness. The radiations were delivered at 180 kv., through 0.5 mm. Cu plus 1 mm. Al, Coolidge tube at 2.5 ma. Irradiations were given through three portals, two temporal and one frontal in each series, the dose being one skin erythema unit per field. Calculated from the Siemens dosimeter, the relative depth dose was 20 to 30 per cent. The number of treatments depended on the objective and subjective symptoms; pauses between treatments averaged about six weeks.

After roentgenization there occurred subjective and also objective improvement in the eye symptoms, especially in the fundus oculi, the field of vision and ability to see. Metabolic disturbances such as polyuria, bulimia and polydipsia were observed to disappear in one of the cases. In the acute case where symptoms of increased intracranial pressure seriously menace the sight of the patient, a decompression should precede roentgen treatment.

The authors' experience covers 15 cases, 13 of which were observed sufficiently long to permit tentative conclusions. A few of the illustrative cases are briefly cited.

Hellebrand, Alois. Mild irradiation. *Strablentherapie*, 1927, xxiv, 728–732.

The doses employed by the author lie between ¼ and ½ H, rarely up to 1 H. The doses were determined by means of the Sabouraud-Holzknecht radiometer in which subjective estimation of the finer gradations plays a considerable rôle. The focal skin distance for superficial processes is 25 cm., for somewhat deeper processes 50 cm., and in deep processes 75 cm. The filter in the first case is 1 mm. Al, in the second case 3 mm. Al, and in the third case 0.5 mm. Zn plus 1 mm. Al.

Temporary improvement was obtained in the treatment of epilepsy associated with menstruation by mild irradiation of the hypophysis. Favorable effects were also obtained in the treatment of periostitis of the upper and lower jaws, and of peribronchitis. Irradiations of the spleen especially in hemolytic icterus, leucemia, malaria and duodenal ulcer were also satisfactory. In one case of diabetes irradiation of the pancreas associated with careful dieting resulted in marked improvement. Results of varying success were obtained in the treatment of tuberculosis of various regions. Complete failure of treatment with mild roentgen irradiations occurred in chronic pneumonia, endocarditis lenta and pernicious anemia. On the other hand, a few cases of marked success in the treatment of anemia and tuberculosis of the cervical spine were obtained and these are briefly cited.

Holzknecht, Guido. Mild irradiation. *Strablentherapie*, 1927, xxiv, 722–727.

The term "mild irradiation" has no very definite limits and the dose considered a mild dose varies considerably from disease to disease. In the case of treatment of malignant tumors the rule should be to apply radiation only so strong as can be tolerated by the surrounding normal tissue and the irradiated region in general. Considerable evidence is now in hand to indicate that in the case of

carcinomas the principle of single maximum doses is not the correct one.

In the field of inflammatory conditions amenable to roentgen treatment the fundamental principle enunciated by Heidenhain is: "The severer the disease, the smaller the dose." This also seems to be true for a number of other diseases among which may be mentioned Basedow's disease. Frequently higher doses are delivered because a previous treatment with a smaller dose was apparently ineffective. This is a dangerous procedure and usually unjustified because results of a roentgen treatment are often delayed quite considerably. One should also keep in mind the fact that certain diseases occur in stages possessing different degrees of susceptibility to roentgen rays. Perhaps the most vicious element that needs control in the matter of roentgen therapy is the natural impatience to secure results in a minimum of time.

Kogan-Jasny, V., and Abramowitsch, Th. The roentgen treatment of bronchial asthma. *Strablentherapie*, 1926, xxiv, 336–342.

A preliminary report is presented of the results obtained in 35 cases varying in age from five to fifty years. Considerable improvement was obtained in 9 cases (25.7 per cent), 23 cases (65.7 per cent) were improved and only 3 cases were unaffected. In a large number of this series the duration of the asthma was from five to more than fifteen years, thus indicating the severity of the symptoms. The technique of irradiation was as follows: The first 8 patients were treated according to the Klewitz scheme, namely, 7 fields of 10 × 15 cm. (4 on the back and 3 on the chest) avoiding the heart region, each field received 20 to 30 per cent of the skin erythema dose filtered through 0.5 mm. Zn. The next 13 cases were treated by the Groedel technique, except that the dose was 25 per cent of the erythema unit, through 4 mm. Al at a focal skin distance of 23 cm. The dose was administered through a single field 12 × 12 cm. in the region of the spleen. The remaining 14 cases received exposures over the lungs and a final single exposure on the spleen. The lungs were exposed in 4 fields with a dose of 20 per cent of the erythema unit through 4 mm. Al, 2 ma. A simultaneous treatment of thorax and spleen seems to have yielded the best results. The effect was usually evident after the first few treatments. Although no claim can be made for the specificity or general effectiveness of the roentgen treatment in bronchial asthma, it seems quite certain that roentgen therapy is of definite value and should be studied further in order that the limitations of the method may be determined and improvements established.

Laubry, Ch. Paroxysmal hypertension cured by roentgenotherapy of the suprarenal region. *Bull. et mém. Soc. méd. d. hôp. de Par.*, 1927, li, 1216–1218.

A patient showing the usual symptoms of hypertension which occurred frequently with intensification of clinical signs, was treated with roentgenotherapy over the suprarenal region with very excellent results. During a period of nineteen days, the patient was subjected to 14 roentgen treatments. Amelioration of the symptoms did not follow immediately, after these irradiations ceased, but frequency and severity of the symptoms diminished. After almost ten days the patient was practically free from pain. Six months later, because of a recurrence of some of the symptoms the patient was subjected to another series of 24 treatments of deep roentgenotherapy. The patient has again taken up his occupation and apparently his condition is practically normal. The symptoms were caused by hyperfunction of the suprarenals and the treatment by deep irradiation of the suprarenals caused a return to normal.

Lechelle, P., Baruk, H. and Ledoux-Lebard. A clinical study of a cerebral tumor (probably frontal) with general paralysis. Clinical cure by means of deep roentgenotherapy. *Bull. et mém. Soc. méd. d. hôp. de Par.*, 1927, li, 785–794.

This case presented symptoms of nervous disorder and general paralysis due to a cerebral tumor. The removal of such tumor is ordinarily impossible, but roentgenotherapy has very often been of much benefit. Although complete and permanent cure is not to be expected in such cases, this form of treatment in many cases will bring about amelioration of the symptoms and restoration of practically normal functions. The authors have presented a detailed report of such a case, giving most attention to symptoms and history, and progress of the patient after treatment. Deep roentgenotherapy was applied to the frontal region, without any other treatment, as follows: there were two series of treatments, the first from Feb. 17 to Apr. 2, and the second from Apr. 25 to May 13, at the rate of three treatments per week. The total number of treatments was twenty-two. These were distributed over four areas, the right and left frontal, right and left parietal. The dose per treatment was about 1,000 r. The total doses

were: right frontal 4,590 R, left frontal 4,700 R, right parietal 5,000 R and the left parietal 4,000 R; 200 kv., 4 ma., rays filtered through 0.5 mm Zn and 2 mm Al. The amelioration of the mental symptoms was suprisingly rapid; after the second treatment the mental symptoms were attenuated, and became progressively less with further irradiations. By the 14th of May the mental condition was entirely normal. Trepanation is not necessary before roentgenotherapy in order to derive benefit from this form of therapy. This case report is another very convincing proof of the efficacy of the roentgen treatment of cerebral tumors. While all cerebral tumors cannot be expected to react to this treatment in the same way, it is shown that under the proper conditions most satisfactory results will be obtained.

Philippon, Henri, Gouin, J., and Bienvenue, A. A case of exophthalmic goiter; treatment by sympathetic functional roentgenotherapy. *Bull. et mém. Soc. méd. d. hôp. de Par.*, 1927, li, 802–805.

This case is of particular interest in that the treatment is based on the synergetic relation of the thyroid and utero-ovarian functions. The usual treatments for exophthalmic goiter were without effect. The patient was then subjected to roentgenotherapy of the thyroid as follows: 600 R, 0.5 mm. Cu plus 2 mm. Al.; under 30 EE were applied, 300 R at each treatment. Following this irradiation, the menses occurred twelve days later and continued two days. Six days later 600 R was administered again. The tumor decreased slightly, but later began to grow again. Local irradiations were given twenty-five days later and again twelve days after this. The thyroid continued to increase in size and the pulse rate also increased. There was no favorable effect on the tumor by direct irradiation. Irradiation of the ganglion centers which lead to the thyroid was also without effect on the enlarged gland, but the symptoms were exaggerated. When irradiations were given to stimulate the utero-ovarian system, favorable results were obtained, not only on the menses, but also on the thyroid gland. There was diminution of the size of the gland, and the symptoms also disappeared.

Porchownik, J. B. The treatment of climacteric symptoms by means of irradiation of the thyroid and hypophysis according to Borak. *Strahlentherapie*, 1927, xxiv, 701–709.

Personal experience in 16 cases convinces the author that the roentgen treatment recommended by Borak for controlling climacteric symptoms deserves consideration especially in instances where other treatments have failed. Two typical cases are described.

Most of the cases treated by the author were between forty-two and fifty-nine years old; 2 cases were of climax precox, aged thirty-six and thirty-eight years. Three of the cases had artificial menopause induced by roentgen rays in the treatment of myoma and hemorrhage. None of the cases gave a history of previous vasomotor disturbances. Very careful examination was made to exclude ordinary hysterias before roentgen treatment was given. The hypophysis received a series of two exposures totalling one-sixth to one-tenth skin erythema dose through portals of medium size in the temples. To attain the above dose at the hypophysis the skin received one-fourth to one-third of the skin erythema dose at a sitting, with rays filtered through 0.5 mm Cu plus 1 mm. Al, focal skin distance 23 cm., 2.5 ma., 180 kv. A pause of not less than three weeks then intervened and in the event of a favorable response the treatment was repeated. Usually this sufficed. In some of the more stubborn cases a third series was given. In 2 cases showing enlarged thyroids and in which the irradiations of the hypophysis alone were not very satisfactory, the thyroid received the same dose through one field (one-third skin erythema dose) and these required two such treatments to show the same satisfactory responses as the cases receiving treatment of the hypophysis alone.

Regaud, Cl. Radiation therapy of carcinoma of the cervix uteri. *Fortschr. a. d. Geb. d. Röntgenstrahlen*, 1926, xxxv, 288–333.

A general review of the subject is given with respect to the methods of radiation therapy, the results and the therapeutic indications. A satisfactory roentgen therapy requires the mastery of two important fields, namely, surgical pathology, of which gynecology is only a branch, and radiotherapy. Both of these subjects may be combined in one head; but they may also function satisfactorily independently provided there is a continuous co-operation between these two major therapeutic divisions.

The author offers two conclusions regarding the better organization of the campaign against carcinoma of the uterus. They are not new but have an immediate interest. (1) The first requirement is the encouragement to obtain the earliest possible diagnosis. This may be obtained by the education of women and of family physicians and also of proper

organization of gynecological examinations in institutions. (2) The second recommendation is a thorough centralization in a small number of gynecological clinics and special institutions with respect to (*a*) surgery, radiotherapy and adequate laboratory facilities. There should be made available an ample supply of radium and of powerful roentgen apparatus; (*b*) a personnel in these institutes of satisfactory competence; (*c*) centralization of the patients; the latter have to undergo but one period of treatment, regardless of the result, and it is therefore of minor importance whether this treatment is administered near to or far from their homes. There are certain physicians who resist recognizing the eventual nature of their cases and obstinately pursue their individual treatments. It would be very desirable to correct the circumstances causing this attitude, for the physician should be actuated by a spirit of co-operation even to the extent of standing back, because cancer is a terrible disease, and requires for its treatment very specialized weapons. For the present there is no other known means besides radiation therapy, promising a completely satisfactory outcome among all the various methods of treating uterine carcinoma.

The author's review includes a discussion of the various radiotherapeutic methods employed in the treatment of uterine carcinoma, together with the various physical and geometric factors of the technique, the biological factors and the handling of the patients preceding and after irradiation.

The results obtained in the Radium Institute of Paris are given in a series of statistical tables. There were a total of 483 cases treated between 1919 and 1924, from which 47 are excluded for one reason or another from the final statement. Of the remainder, 282 died without cure by radiotherapy. There remain 33 not improved and 4 cured after a subsequent hysterectomy. This gives a total of 319 failures of radiotherapy. The number of cases apparently cured by radiotherapy is 117, or 26.8 per cent. In the group of cases with infiltrated parametrium (third degree) and in very far advanced cases (fourth degree), the number of cures by radiotherapy was 17.7 per cent (43 out of 281 cases). In the group of cases with the disease limited to the uterus (first degree) or to the immediate vicinity (second degree) the percentage of cure was 42.4 per cent (75 out of 202 cases). Cases in Group I alone showed 54.2 per cent cure. Of the cases regarded as "cured," 9.8 per cent dropped out from the second to third year; 17.9 per cent from the second to the fourth year and 26.1 per cent from the second to the fifth year.

Schiller, Viktor, and Altschul, Walter. The roentgen treatment of ulcers. *Strahlentherapie*, 1927, xxiv, 736–740.

Early ulcers without exception should receive radiation treatment. The radiation treatment seems to be far more advantageous than customary procedures because it institutes rapid improvement in the average case and renders the patients capable of resuming their occupations within a few weeks. Older ulcers should also be irradiated. Cases to be excluded are, *a priori*, those in which there is a demonstrable stenosis or the beginnings of a stenotic process. Hemorrhages are no contraindication to radiation treatment. Cases which show a negative response to the first series of irradiations and continue to lose weight should be suspected of having a malignant condition and should be operated on.

Roentgen treatment with small doses seems to be the most satisfactory; indeed, the most rapid responses have been obtained with the smaller doses. The region of the ulcer is marked on the skin of the abdomen and the back, and irradiation is given through a 10 × 10 cm. field, at a distance of 30 cm. with 4 H, through 0.5 mm. Cu, 160 kv. If hemorrhages are also present in the case a single dose over the region of the spleen is also administered. This dose suffices in most of the cases. Occasionally a second one may be required a month later. Five illustrative cases are cited.

Seitz, Ludwig. Stimulative irradiations in female disorders. *Strahlentherapie*, 1926, xxiv, 227–252.

A review is presented covering the following general aspects, which are briefly discussed: (1) Stimulative irradiations of the ovary in polymenorrhea, dysmenorrhea, hypofunctional disturbances of the ovary. (2) Action on ovarian cycle by stimulative roentgen irradiations of other endocrine organs: irradiations of the hypophysis, of the thyroid gland. Treatment of climacteric symptoms by irradiations of the hypophysis and thyroid. Spleen irradiations in ovarian disturbances. (3) Stimulative irradiations of other organs and systems, the vegetative nervous system inflammatory diseases, tuberculous pelvic conditions and tuberculous peritonitis, hemostasis by irradiation of the spleen. A bibliography is appended.

Steiner, Georg. The effect of external factors on the development of late injuries. *Strahlentherapie*, 1927, xxiv, 748–749.

Two cases are cited. In the first, a woman had received a castration dose and responded with a mild local erythema. Fourteen months later mechanical skin irritation and a roentgenogram taken at that time caused the appearance of a late ulcer which under treatment disappeared very quickly.

In the second case, the patient suffered from a chronic impetiginous eczema of both hands associated with acquired syphilis. The roentgen treatment despite great care caused a reaction of the first degree on three fingers but this receded shortly and left a slight pigmentation. The patient was cautioned against the use of iodine, iodoform, brushes, etc. Eighteen months later a pustule developed on the back of a finger and the patient painted it with tincture of iodine. The result was a definite ulcer which terminated in atrophy and telangiectasis. The author asks what is the responsibility of the roentgenologist in view of the external factor illustrated in the second case.

Strauss, Otto. Spontaneous cure of carcinoma and its relation to radiation therapy. *Strahlentherapie*, 1927, xxiv, 672–700.

An analysis of the reported cases of genuine spontaneous recovery (1) from carcinoma or carcinoma recurrence; (2) from carcinoma following palliative operation; (3) following incomplete operation of carcinoma is presented with the purpose of determining the reliability and general applicability of the findings. Additional evidence is sought in the reported effects of febrile diseases upon the spontaneous recovery process and upon spontaneous recovery from sarcoma. The evidence indicates that there is no natural recovery from cancer and the therapist therefore cannot copy nature in planning the treatment of the disease. It follows therefore that any attempt to produce by means of radiation therapy the effects supposed to occur naturally is doomed to failure in advance.

Radiation therapy must be designed to produce a definite local effect. It is as yet not definitely established that there occurs simultaneously an effect upon the hematopoietic organs through necrohormones. The author regards the latter hypothesis as probable, but the effect is probably a secondary one. The point of attack in radiation therapy is and must always be the cancer cell itself. The theme of spontaneous recovery in carcinoma has tended in some circles to deflect the true aim of radiation therapy and threatens to lead to sterile experimentation.

Vallery-Radot, Pasteur; Gilbert, P., Blaumoutier, P., and Weyland, J. Roentgenotherapy and pilocarpin in the treatment of two cases of syndrome of Mikulicz with salivary hypocrinism. *Bull. et mém. Soc. méd. d. hôp. de Par.*, 1927, li, 410–418.

The anatomical lesions in the syndrome of Mikulicz consist of an infiltration of glandular tissue by lymphocytes. The nature of these lesions is such that roentgenotherapy very often gives good results. There is, in effect, a particular sensitivity of the lymphocytes to roentgen rays. Disturbance of salivary is secretion causing insufficient flow of saliva often involved in the syndrome of Mikulicz. Two case reports are given in which roentgenotherapy was used to advantage in reducing the swelling of the parotid gland and in one the hypocrinism disappeared. In the other case the swelling disappeared following roentgenotherapy, but it was necessary to use pilocarpine to restore the salivary secretion. Excellent results in treating this condition by means of roentgenotherapy have been reported by others.

The method for treating with the roentgen ray is as follows: Resistance coil giving about 120,000 volts; focal distance 25 cm., filtered through 5 mm. of aluminum; area of 10 cm. in diameter; dose given at each treatment and on each parotid gland is 500 R; six applications of moderately penetrating rays at intervals of one week. After the third treatment there is a marked diminution of the swelling; after the fourth treatment the swelling has almost entirely disappeared, and usually the salivary secretion has increased. After the fifth irradiation the gland is normal, and salivary secretion is usually restored after the sixth treatment. When pilocarpine is found to be necessary to restore salivation, it is given one-half hour before the two principal meals, 5 mg. each time. This treatment is continued until proper salivary secretion is restored.

Vallery-Radot, Pasteur; Gilbert, P., Blamoutier, P., and Claude, F. Treatment of asthma and of spasmodic coryza by means of roentgenotherapy. *Bull. et mém. Soc. Méd. d. hôp. de Par.*, 1927 li, 456–459.

This is a preliminary report on 52 of 80 cases treated by the authors and only a summary of their results is given. Detailed case reports on the complete series are to be published later. The method of treatment is as follows: 10 to 12 successive treatments are given at intervals of twice a week; the site of treatment was the thorax or spleen; 5 to 6 treatments on the thorax followed by 5 or 6 treatments on the spleen. If results are not obtained, this series is repeated a second and in some cases a third

time. The dosage used was 500 R per treatment, moderately penetrating, over the mediastinum or the hilum of the lung. The results obtained are as follows: in 12 cases the asthma or coryza disappeared completely; 21 were appreciably ameliorated, while in 19 no favorable results were obtained.

It is not possible to explain the favorable effects obtained with this treatment in the cases noted, and it is too early to estimate the probable percentage of cures to be expected. It is also impossible at this time to indicate which kinds of asthma are susceptible to this treatment.

Vogt, E. Development of sarcoma of the uterus and the ovaries following roentgen irradiation. *Strahlentherapie*, 1926, xxiv, 313–314.

Up to now, 7 cases of sarcoma of the uterus and 2 of sarcoma of the ovary have been reported; and the author has observed 3 successive cases of sarcoma of the uterus following roentgen castration. In these cases diabetes was a complicating factor and roentgen therapy failed. Possibly the employment of insulin therapy might have been of value.

Although the author holds no belief that there was any causal relation between the tumor formation and the previous roentgen treatment, it would seem that if such a relationship did exist it might be explained as follows: From the experiments of Carrel on sarcoma development, it may be assumed that there exist, in addition to substances produced by bacteria, also those caused by roentgen injuries, substances stimulating the development of sarcoma. The cells would become altered in the sense of the Rous principle.

v. Liebenbstein, A. General irradiation of the human body with roentgen rays. *Strahlentherapie*, 1926, xxiv, 324–326.

In hopeless cases which are no longer amenable to local irradiation, the method of general irradiation seems to offer some possibilities which justify its use. The procedure was employed in cases of lung carcinoma, stomach and liver carcinoma, lymphosarcoma and advanced carcinoma of the body and cervix of the uterus. The treatment was applied in 18 cases. The doses administered varied from 2 × 30 e on the skin in 2 × 2½–3 hours down to 2 × 5–7 e in 2 × 20–30 minutes. Some of the doses were repeated two, three and four times, the last being repeated sixteen times with intervening pauses of varying length. It was established that this kind of treatment was tolerated and apparently produced no injurious effects. In 3 cases, which are briefly cited, the treatment produced a decided temporary inhibition of the tumor growth.

Weil, Oskar. Therapy of transverse lesions of the spinal cord. *Strahlentherapie*, 1927, xxiv, 745–747.

Experience in the treatment of six tumors of the spinal cord is briefly reported. In each case a number of lumbar punctures were made, the spinal fluid examined chemically and microscopically, and following this, roentgen treatment was given. One to three days after irradiation, another spinal puncture was made and the results compared with the first. In cases having roentgen-sensitive tumors, there occurred (1) decrease in the volume of fluid; (2) decrease of intraspinal pressure; (3) marked increase in protein content; (4) absence of an inflammatory pleocytosis, and (5) practically complete destruction of the visible cell elements in the spinal fluid.

The plan of irradiation was generally as follows: The Coolidge tube was operated with a Neo-Symmetrie apparatus, 38 to 40 cm. spark gap, filtration through 0.5 mm. Zn plus 2 mm. Al, dose 5 to 7 H. The rays were carefully centered over a small spinal region by means of a lead glass speculum having an oval opening 3 cm. long. The patient received the treatment in the lateral position and the speculum was placed at an angle of 40 degrees to the median plane. Three exposures were given in one series. The second exposure was made six weeks after the first and the third six to twelve months after the first.

In 4 of the 6 cases the microscopic and chemical examinations of the lumbar puncture fluids corresponded with the recession of the symptoms. In the 5th case there was no response to the roentgen treatment and no change in the results of the examinations of the spinal fluid. When the results of roentgen therapy indicate that the spinal tumor is not roentgen-sensitive, then operation must be resorted to.

Wesseling, Mathilde. Roentgen treatment of genital tuberculosis at the Freiburg Female Clinic. *Strahlentherapie*, 1927, xxiv, 459–464.

Genital tuberculosis is best treated by medium roentgen doses of about 40 e applied abdominally and sacrally and repeated after intervals of six weeks. In conjunction with this, general treatment by rest in bed, good nourishment, air and light therapy should

not be neglected, in view of the fact that the disease is not a simple local infection even though manifest signs of tuberculosis are not demonstrable in the other organs. From this standpoint it would appear that the effect of roentgen rays is not so much a simple local one as a general one upon the whole organism, generally influenced by the disease. Four illustrative cases are cited. During the period 1918 to 1926 over 123 cases were treated. There were 65 cases of adnexal tuberculosis; 47 were cured and 17 were improved. There were 35 additional cases with peritoneal complications. Of these 19 were cured, 7 improved, 2 had recurrences and 7 died. Of 23 cases of tuberculosis of the urinary system, 18 were cured, 2 had recurrences and 3 died.

The technique of irradiation was as follows: One large field abdominally and sacrally 24 × 24 cm., 50 cm. focal skin distance, 1 mm. Cu (occasionally 0.5 mm. Cu plus 1 mm. Al), Coolidge tube operated at 2.5 to 3 ma., 180 to 200 kv. The dose was 2 × 40 e on the skin, measured with a Friedrich dosimeter, 1·0 e being equivalent to one skin unit dose.

Wintz, Hermann. Action on endocrine glands by roentgen rays. *Strahlentherapie*, 1927, xxiv, 412–438.

The author reviews his experience in this field extending over the past ten years. One of the major difficulties lies in the exact dosage of the endocrine organs. By taking account of the superposed dosage due to scattered radiation, of the Compton effect and of the space dose, it is now possible to deliver a more or less exact measurable and reproducible dose and with this control it is possible to induce the following different effects: (1) the total destruction of a gland; (2) the temporary injury of all cellular elements to a degree rendering recovery possible in the more resistant elements; (3) permanent destruction of the other sensitive cellular elements and non-injury of the less resistant cells; (4) stimulation of the cell.

In the ovary different degrees of roentgenization have been shown clinically to produce total castration, permanent amenorrhea, or temporary sterilization; and in all these conditions the histological changes in the ovary parallel the clinical findings, thereby demonstrating that the various cellular components of the ovary possess different degrees of sensitivity toward the roentgen rays. It is possible to designate these differences in quantitative terms. It has been found that temporary sterilization by roentgen rays leaves active a portion of the essential endocrine activity of the ovary. This is demonstrated by absence of climacteric symptoms and of the metabolic changes which are characteristic for permanent amenorrhea or total castration.

A discussion is given of the various types of diseases due to reciprocal malfunction of certain glands in so far as they relate to roentgen treatment. Concerning the interrelation between the ovary and thyroid, the following points have been established: (*a*) *Thyreogenic dysfunction of the ovary*. This group includes polymenorrheas, and dysmenorrheas arising from hyperfunction of the thyroid; and roentgen treatment of the thyroid is indicated for this group. (*b*) *Oophorogenic hyperthyreosis*. This includes cases in which there is usually a primary ovarian disturbance due to inflammatory changes and in which hyperthyreosis develops subsequently. Irradiation of the thyroid is not indicated but temporary sterilization has been found effective in controlling the condition. (*c*) *Dysfunction of the ovary as a consequence of hyperthyreosis*. In this type the most important symptoms are polymenorrhea, intensified and protracted menstrual hemorrhage associated with hypofunction of the thyroid. Roentgen treatment of the ovaries is contraindicated in such a case. Amenorrhea due to hyperthyroidism is suitably treated with thyroid preparations. Stimulative roentgen therapy should not be employed.

In the group of conditions due to reciprocal malfunction of the ovary and hypophysis and of the ovary and thymus, experience shows the great necessity for watching carefully for possible relations to the individual glands. If this precaution is not taken mistakes will occur and even serious injury to the endocrine system may be the result.

Zweifel, E. Treatment of mastitis with roentgen rays. *Strahlentherapie*, 1926, xxiv, 318–323.

The radiation treatment should be applied as soon as possible in early mastitis as recommended by Heidenhain and Fried for general inflammation therapy. If an abscess is already present there is not much purpose in irradiating except possibly for relieving pain; and an incision cannot be avoided. In the treatment of mastitis by irradiation the patients very frequently report that the pains disappear almost immediately after treatment. Considerable relief results and the patients are able to sleep comfortably. Objectively there was frequently noted an almost critical drop in temperature to normal following treatment. A decrease of 2 to 3 degrees in twenty-four hours is not at all unusual. The correct employ-

ment of roentgen rays in the treatment of mastitis involves no hazard to the patient. The patient on first examination receives, of course, the customary treatment, namely, moist compresses and support of the breast; in addition, saline laxatives are administered.

The dosage is of major importance. The field of exposure is made to extend somewhat over the visible limits of inflammation, and 20 per cent of the skin erythema dose is delivered at a 30 to 40 cm. focal skin distance. This corresponds to about 150 R, as recommended by Martius. The radiations are filtered usually through 0.5 or 1.0 mm. copper, and in some cases satisfactory results have also been obtained after filtration of the rays through 3 mm. Al; filtration through 0.5 or 1.0 mm. Zn may also be employed. In general, only one exposure should be given. No cases have been observed to get worse after treatment with the recommended dosage. Statistics on the treatment cannot yet be given since the procedure has been employed only since 1925.

MISCELLANEOUS

Altschul, Walter. International regulation for radiation protection. *Strahlentherapie*, 1927, xxiv, 766–768.

A brief discussion is presented of certain recommendations recently proposed, and it is concluded that although the proposals are desirable they are too strict for a general application. It is claimed that such strict rules are desirable only for the few roentgen institutes working under full load. On the other hand, the large majority of roentgen institutes do not require these regulations. A distinction should be set up between protective regulations for large and for small institutes and two corresponding sets of rules should be made. For conditions in Germany, it is believed that the legal establishment of such rules is not indicated.

Andersen, Ernst, and Emmerich, Emil. The effect of roentgen irradiation on the complement from guinea pigs irradiated *in vivo*. *Ztschr. f. Immunitätsforsch. u. exper. Therap.*, 1926, xlvii, 565–570.

Complement irradiated *in vivo* does not affect the outcome of the Wassermann reaction; and the amount of complement appears to be increased rather than decreased by the treatment. Bleeding of the guinea pig appears to cause a decrease succeeded by a slight increase of complement.

In the above experiments the irradiation was given at 40 cm. focal distance, portal 6×8 cm., 116 to 124 potential hardness, filtration through 3 or 4 mm. Al, or 0.5 mm. Zn plus 1 mm. Al, the dose administered being fractions up to one human skin erythema dose.

Dyroff, Rudolf. Experiments on injury to the offspring by roentgen rays. *Strahlentherapie*, 1926, xxiv, 288–312.

Experiments on rabbits and guinea pigs showed that a single irradiation of a parent caused no demonstrable injury in the offspring down to the F_3 generation. This negative effect was found: (1) when fertilization occurred immediately after irradiation with small doses and with so-called sterilization doses; (2) after deferred fertilization following small doses and after cessation of temporary sterility, (3) injury to existing pregnancy or to the fetus by indirect irradiation.

From a practical standpoint the significance of injury to the ovum, in contrast to injury to the embryo, is essentially a question whether a viable deformed offspring may be expected to appear after several generations as a result of irradiation of a single parent or of both parents. In the former instance, the hypothetical injury would tend to be less frequent in accordance with Mendel's law and the probability of its occurrence in later generations would be rather low as compared with that following irradiation of both parents.

Although there is a possibility of the occurrence of non-viable, malformed embryos following irradiation of the ovary of the mother there has not yet appeared any very substantial evidence regarding the appearance of viable malformed embryos from ova injured by radiations. The author emphasizes that the establishment of this particular point is important despite current views to the contrary.

Friedrich, W. The Compton effect and its significance in radiation therapy. *Strahlentherapie*, 1926, xxiv, 193–217.

A review is presented of the physical phenomena associated with the Compton effect. The result, in general terms, is that a primary radiation of essentially homogeneous character after impinging on a body becomes scattered, and the recoil electrons produced set up a series of secondary radiations of widely heterogeneous characters. The significance of this phenomenon to radiation therapy is at once apparent. Some of the broad qualitative effects have been established but the quantitative aspects remain to be worked out. The passage of radiations through the tissue releases electrons which produce the biological effect

and it is believed that pure absorption, i.e., the photo-electrons, cause the biological effect. Since the energy of the photo-electrons for any wave length of primary radiation is defined by the Planck-Einstein quantum equation, attempts have been made to explain the variable biological effects of rays of different hardness on the basis of differences in the electronic energy. We know now, however, that the Compton effect causes the generation of recoil electrons which are biologically active and whose effects must be added to those of the photo-electrons.

With increasing hardness of primary radiations, the pure absorption of photo-electrons by the biological material (containing components of low atomic weight) will become less and less in comparison with the production of recoil electrons. The Compton effect, therefore, would appear to have a sort of equalizing action on the radiation effect; with soft radiation there is a predominance of rapid photo-electrons, and with increasing hardness the latter diminish and are replaced by recoil electrons with ever increasing energy. This may explain the reason for the absence of considerable differences in the nature and course of the biological effects produced by rays of different hardness. Also the strong biological effect of hard gamma radiation whose absorption in the body tissues is extraordinarily low becomes understandable as an effect of the recoil electrons.

Fritsch, Ernst. Errors in dosage of roentgen rays due to false indications of the milliammeter and their elimination. *Strahlentherapie*, 1927, xxiv, 719–721.

There is as yet no means known for preventing false readings in the tube current milliammeter. A check, however, may be easily made by the employment of two milliammeters attached in series in the tube circuit, one of the ammeters being short-circuited by a removable metallic connection between its terminals. The author describes a patented device which has been employed in various clinics apparently with satisfaction.

Gabriel, Gerhard. Physical and biological studies on so-called "grenz" radiation. *Strahlentherapie*, 1927, xxiv, 534–547.

Two tubes were compared, operated on relatively constant direct current at potentials between 6 and 12 kv. These tubes showed distinct differences in radiation output at the same voltage and milliamperage. It is probable that these differences are due to variations in the anticathode material and arrangement of the anode with respect to the anticathode. Differences in penetration may also have been due to differences in the thickness of the Lindemann windows.

Biological experiments were made on rabbit skin and on human skin. Exposure of the rabbit ear caused a dilatation of the vessels, epilation, ulceration and formation of scale. The reaction was found to depend on the intensity and duration of exposure. In the irradiated human skin there occurred very early an increase in the capillary coils, development of the deep network, dilatation of the vessels and early pigmentation. Increase in capillarization occurred also where no distinct macroscopic reddening appeared, i.e., when irradiated with low voltage or for very short time. Larger doses caused blistering and softening of the epithelium. The underlying skin was smooth and white but the capillary microscope revealed altered vessels. The capillary microscopic reaction of the erythema differed from the usual erythemas only in the early occurrence of the capillary reaction and the early pigmentation; the course followed was otherwise the same.

A consideration of the author's results as compared with those reported by Bucky and others shows that further study of the subject should be made in order that the facts may be established without prejudice. However, the present studies have disclosed no reason for describing these "grenz" radiations as particularly different from roentgen rays in general.

Glasser, Otto, and Meyer, William H. Erythema doses in roentgen units. IV. *Strahlentherapie*, 1927, xxiv, 710–714.

A careful check was made of the relative values of the electrostatic dose units determined by Duane, Bachem, Beets and Arens, and the authors found essential agreement with the values of the first two. The Beets and Arens unit was found to be only 56 per cent of the authors'. Careful measurements with six different standardized ionometers were made. A comparison of the average value of the roentgen unit established in the calibration of the German instruments with the authors' unit showed that the German R unit was somewhat 50 per cent greater than the Duane-Bachem-Glasser electrostatic R unit. The reason for this discrepancy is not yet clear. The authors' erythema dose for hard radiation (of 1300 R with recoil scattering and) of 900 R units measured in air without scattering corresponds to 600 German R units.

The results of the above investigation are unsatisfactory and show the need for further

research and co-operation before mastery of the difficulties of standard dosimetry can be attained. The authors' unit has remained constant since its establishment four years ago and was found independently to agree with those of Duane and of Bachem. However the discrepancy with the Behnken roentgen unit is very great and demands solution.

Glocker, R., and Kaupp, E. A thimble chamber independent of the quality of radiation so far as concerns the R readings; and on the measurement of superposed scattered ray dose in the water phantom. II. *Strahlentherapie*, 1927, xxiv, 517–523.

Research on the relation between wave length and electronic emission from the lighter elements may make it possible to construct a thimble chamber yielding readings proportional to the biologic effect. A prerequisite for this is a thorough understanding of the variation of biological effect with ray hardness under constant R dosage. An examination of the relation between wave length and the electronic emission from aluminum showed that it was appreciably different from that of air, and of particular interest is the great decrease obtained with soft roentgen rays.

The effect of chamber length on the magnitude of the recoil scattering at the surface of a water phantom was examined, and it was found that with constant focal distance of the water surface there were only slight variations in the superposed scattered ray dose with variation in the length of the chamber, i.e., the chamber entirely immersed, half immersed and out of the water phantom. In transferring from very lightly filtered radiation of low voltage to heavily filtered radiation the superposed scattered ray dose at the surface increases typically, on the other hand, it shows a decrease as soon as the tension is pushed beyond 200 kv. This is explained on the basis of the Compton effect, namely, that as one goes to radiations of smaller wave length an increasingly greater proportion of the scattered radiation energy is transformed into electronic energy.

Holthusen, H., Schuback, A., and Sielmann, H. Sensitization by secondary rays from metal surfaces. *Strahlentherapie*, 1927, xxiv, 577–606.

Experiments are reported on the effects produced on photographic emulsions and upon surface bacterial growths. The effect of roentgen rays upon bacterial growth was determined quantitatively under various experimental conditions. It was found that the sensitiveness of *B. prodigiosus* (defined in terms of percentage killed by a certain dose) is not very slight but rather of the same degree of magnitude as that of other small organisms characterized by wide individual variations in sensitiveness to radiation. The relatively large radiation sensitiveness is not peculiar to *B. prodigiosus*, but is of the same order of magnitude as that found for other organisms (*Bact. typhosus*, *Bact. coli*, staphylococci). In considering the effects produced by secondary rays emitted from flat metallic surfaces, the results will depend largely upon the conditions under which the measurement is undertaken. It is important therefore to remember that the establishment of a secondary radiator, for instance, as a diffuse distribution in a sensitive substrate like photographic emulsion or solution, may be of an entirely different order from that anticipated.

In the studies both on photographic emulsions and bacterial cultures, it was apparent that the end-result was a combination of the effects of secondary radiations and of photoelectrons emitted during absorption. Secondarily there was an added effect due to scattered electrons, which was especially evident with hard radiations. The extent to which these three types of secondary radiations contribute to the increased effect varies according to the three different methods employed for studying these radiations: (1) measurement by the method of air ionization permitted the best numerical determination of the effect of secondary wave radiation and secondary electron radiation.

The data obtained show that the effect of the electron radiation was usually at least ten times or more than the secondary wave radiation. (2) The effect of electron radiation was most apparent in the experiments with bacterial cultures. In this case the effect of the secondary wave length radiation was somewhat greater than in the air. There seems no doubt that the great accelerating effect of metallic secondary rays is due to the photoelectrons. (3) The results obtained by the photographic method agree with theoretical considerations. In the action on the photographic emulsion the secondary electron radiation assumes a dominant rôle and the change in intensity of the total secondary radiation as shown by the effect on the photographic emulsion is governed by the laws for secondary wave radiation. By eliminating the secondary electron radiation through interposition of a sheet of paper between the metal surface and the photographic film a method was developed

for estimating the absolute value of the secondary wave radiation.

Holzknecht, G. Injury prevention. *Strahlentherapie*, 1927, xxiv, 385–411.

Safety devices with mechanisms susceptible to failure are obviously more dangerous than the absence of such devices, because they engender a false sense of safety in the operation of roentgen installations. However, the employment of devices preventing operation when the filter is missing, the use of two timers instead of one, of fluorescent protective material, surface dose control in addition to timing of the dose, all these are now well beyond the experimental stage and sufficiently reliable to merit serious consideration. For the conscientious worker they tend to maintain peace of mind concerning the mechanical elements of the work, thus permitting greater attention to the problem of giving the patient the highest degree of service. An interesting psychological situation appears from the fact that manufacturers of reliable protective devices are unable to arouse serious interest in their use among those roentgenologists who have not yet encountered an accident.

Brief descriptions are given of filter safety devices, time alarms and time switches, potential controls, duplex dose controls and integrating surface dosimeter, luminescent shields to indicate stray radiations and a universal direction finder.

Jona, M. The physical dose and biological effect. *Strahlentherapie*, 1927, xxiv, 757–761.

Careful series of measurements show that for the attainment of equal biological effects, as is the case for the ionization effect, the action of the radiation shows a constant increase from the softest rays, which are least effective, to the hardest, which are most effective. These results are in contradiction to many current views regarding the effects of soft and hard rays. It seems, however, that one may say with assurance that there exists a uniform and direct dependence of the biological effect upon the wave-length whether measured in terms of ionization effect or in terms of the amount of energy absorbed by the skin. In relation to equal amounts of absorbed energy, this dependence is much lower than in relation to equal ionization effect. When measurements for studying this problem are made with instruments unaffected by variations in wave length, results are obtained which appear to be more reliable and which indicate that the biological effect is constant when the dose is so controlled that the same amount of energy is absorbed in the skin.

Klövekorn, G. H., and Gaertner, O. The erythema dose in R units for copper radiations. *Strahlentherapie*, 1926, xxiv, 365–367.

Measurements were made with the radiations delivered from a copper anode, the average wave length being 1.47 Å. Exposures were made at a distance of 76.6 cm., 50 kv., effective, 9 ma., intensity corresponding to 2.09 R per second. A small field on the skin of the forearm was employed for test. Doses of 300 to 350 R showed no visible effect up to eight days. The dose was then increased to 425 R, and ten hours after exposure a definite erythema was observed, followed by the usual sequence of blister, burn, superficial ulcer and healing. It is therefore concluded that the erythema dose for copper radiations is approximately 380 R, the same value as that determined by Klein and Gaertner for radiations of 0.43 A. This seems to indicate that the skin dose in R units is apparently a constant for a wide range of wave lengths.

Klövekorn, G. H., and Gaertner, O. Roentgen rays and unicellular organisms. II. *Strahlentherapie*, 1927, xxiv, 548–550.

A study was made of pathogenic filamentous fungi and fresh water amebae. The fungi were the following: *Trichophyton crateriformi*, *Trichophyton lumbiicatum*, *Achorion quinckeanum* and *Sporotrichon beurmanni*. All were readily grown on Sabouraud maltose agar. The cultures were transferred to the medium and irradiated immediately after inoculation. Three controls were included in each test. The radiations were produced with a Radio-silex apparatus, Müller tube with copper anode, 50 kv. effective, 9 ma., 7.5 cm. focal distance. The intensity of the unfiltered radiation at 7.5 cm. distance was 485 R per sec. The mean wave length was 1.47 Å, corresponding to approximately 0.06 mm. half-value layer of aluminum or 0.8 mm. half-value layer of water. All the fungi were found to be killed after exposures of 10 to 10½ min., the dose being 290,000 to 305,550 R. Exposure for 9 minutes permitted a retarded growth which was perceptible even after three to four weeks.

The irradiations of amebae were made in open glass dishes. The striking fact was that under the experimental conditions the protozoa were very much less sensitive than the bacteria and fungi studied. Distinct inhibition of movement occurred only after irradiation for forty-five minutes. Exposure for one and a

half hours was not sufficient to cause entire cessation of movement.

Krause, Paul, and Kruchen, Carl. The roentgen therapeutic section of the University Medical Clinic, Münster i. W. *Strahlentherapie*, 1927, xxiv, 474–484.

A description is given of the new installation and its operation. The design of the plant includes features satisfying the demands of practical therapy, scientific research and facilities for instruction. The original must be consulted for details.

Küstner, Hans. The Göttingen calibration apparatus, a new portable dosimeter of uniform and constant sensitiveness. *Strahlentherapie*, 1927, xxiv, 501–516.

The ionization method appears to be the only one capable of employment in a dose-measuring instrument which is expected to yield constant readings of sufficient accuracy and which is capable of calibration in r units independent of the ray hardness. Uniform constancy is obtainable in an ionization apparatus in a most satisfactory manner by comparing the ionization effects of the roentgen rays in terms of a radium preparation. It is immaterial between what two scale divisions the reading is made so long as the effects of the radium and of the roentgen rays are read off between the same divisions. This procedure eliminates a number of factors that control the sensitiveness of the apparatus, i.e., barometric pressure, capacity and other factors which may vary without affecting the readings. Even the stopwatch with which the discharge is timed may be slow or fast without affecting the calibration, the theory being that the effects of both the roentgen rays and radium radiations are influenced to the same degree and therefore the influence of the external factor is cancelled out.

In the apparatus described by the author use is made of the above principle, the ionization chamber being a rather large one of 13 cm. diameter and 30 cm. length. The large chamber has many advantages among which is the maximum utilization of the ionizing effect of the preparation. By the use of suitable screens to control the rays entering the chamber, the discharge rate of the electrometer can be controlled to a convenient magnitude no matter what the radiation intensity, the focal distance or the local conditions surrounding the particular apparatus to be calibrated.

The radium preparation for this apparatus is inclosed in a 5 mm. sealed bulb. This is embedded in cork and inclosed in a cylinder of "electron" metal of 0.4 mm. wall thickness. This holder can be screwed into the apparatus when a measurement is to be made and when not in use is screwed into a brass cylinder lined with lead and removed several meters away from the apparatus. In the preparation of the radium bulb it is necessary that the material fill the bulb completely so that there shall be no movement when the bulb is turned. Since the ionization of both the beta and the gamma rays is utilized there is a possibility that with free movement of the radium powder in the bulb the beta radiation in various portions of the bulb might be absorbed to different degrees and thus cause significant variation in the ionization which is measured. Experiment shows that this variation may be quite considerable. It was found that constant readings of the roentgen dose could be made when the dosimeter occupied the same position for the roentgen measurement as for the control measurement with radium.

Leist, M. On the effect of roentgen rays and radium on teeth and jaws. *Strahlentherapie*, 1926, xxiv, 268–281.

The point of attack in the action of roentgen rays and radium upon the teeth is in the odontoblasts. Injury of the odontoblasts leads to disturbances in dentine formation. No changes caused by the roentgen rays could be discovered in the ameloblasts and enamel. The odontoblasts in the germinal layer of the teeth exhibit a high degree of sensitivity. In the growing teeth of the dog, the effect of irradiation may lead to cessation of growth and falling out of the teeth. In the latter case there occurs involvement also of the dental periosteum, alveolar bone and bone marrow. The general effect of roentgen rays and radium is one of retardation of the process of dentition.

A dose of 2 to 5 skin erythema units was sufficient to cause reticular atrophy of the pulp in the mature molars of the rat. The clinical determination of radiation injuries in the pulp is not satisfactorily established by the customary electrical test for vitality, and only a negative test of this kind appears to be of any value. A positive result does not exclude pulp injury by the radiation, because odontoblasts and pulp cells may be considerably injured while the pulp nerve is still unaffected and able to respond normally to the current. The cases described in the literature of roentgen and radium injuries to the alveolar bone appear to be sequelae due to excessive dosage or overlapping of fields caused by crossfiring in the mouth cavity and accumulation of

effects in the bone. An additional source is occupational exposure.

Liebersohn, J. G., and Schimanko, I. I. Change of the Pirquet reaction under the influence of different doses of roentgen rays. *Strahlentherapie*, 1926, xxiv, 343–347.

Exposure to doses of 6 to 12 X was given in 33 cases, and 41 Pirquet tests were performed before and after irradiation. There was a diminution in the Pirquet reaction in 29 of the tests (70 per cent). A dose of 1 to 2 X was given in 22 cases and 6 showed increase in the Pirquet reaction, 10 showed no change and 6 showed a decrease. When the dose was $\frac{1}{2}$, $\frac{1}{4}$ or $\frac{1}{8}$ X (in 45 cases), 31 cases, or 67 per cent, showed an increase in the Pirquet reaction and 4 cases (9 per cent) a decrease. In other words, relatively large doses produced weakening of the reaction in 70 per cent of the cases, while small doses produced an acceleration in 67 per cent of the cases. The maximum of decrease could be noted between the seventh and fourteenth day after roentgenization; and after 21 days this was no longer demonstrable. It is as yet impossible to determine accurately and for all cases the particular dose that will act in a stimulative manner because individual sensitiveness of the substrate undoubtedly plays an important rôle. This sharp difference in the outcome of the Pirquet reaction, small roentgen doses causing one effect and larger doses causing an entirely different effect, justifies the assumption that the roentgen rays in suitable doses exert both a depressing and stimulating effect which can be differentiated.

Mutscheller, A. Uniform voltage *vs.* pulsating currents in clinical deep therapy. *Radiology*, Feb., 1927, viii, 121–126.

When a constant, non-variant voltage is applied to a roentgen tube a definite wave length intensity distribution or spectrum is obtained. A spectrum of this kind is conveniently represented diagrammatically in the ordinary two dimensional space diagram. But when a varying voltage is applied to the roentgen tube a series of spectra will be produced, the minimum wave lengths and the maxima of which shift toward the longer wave length end of the spectrum as a function of the voltage; and thus an infinite series of spectra results which requires a third dimension to portray graphically.

Unlike mechanically rectified high voltage current, the constant voltage current produces, with the same voltage, always the same spectrum; and since the influence of rectifier and changing primary voltage characteristics are entirely eliminated, it is fully possible to express and to compare doses in terms of milliamperes and volts applied to the tube. Constant voltage current produces a spectrum with the largest possible component of short wave length rays and conversely, a varying voltage always produces a spectrum whose maximum intensity is shifted toward the long wave length end, and it therefore is richer in the less penetrating rays.

It is concluded, therefore, that surface doses obtained with constant voltage radiations are considerably larger than those obtained with rectified current and that the depth doses of constant voltage radiations are increased in a greater proportion than surface doses. The average length of the constant voltage radiation is distinctly shorter than that of the pulsating current radiation, and the spectra show clearly that the constant voltage radiation contains a smaller percentage of long wave length than the pulsating current rays. Due to this fact the same extent of absorption uniformity or "homogenization" can be obtained with a thinner filter in the case of constant voltage rays than with pulsating current rays. For equal energies forced through the tube, the useful penetrating radiation from constant voltage current at 200 kv. is on the average slightly over one and a half times as great as in the radiation obtained from pulsating current rectifiers. It is found that the advantages of constant voltage current distinctly increase if the tube can be operated at still higher voltages. Constant voltage current may bring about a distinct reduction in the erythema dose time but the real advantages of a constant voltage current begin to become increasingly prominent and really worth while at about 200 kv.

Podljaschuk, L. D. Experiments on the relations between the hypophysis and other endocrine glands. 1. The reciprocal relations between the hypophysis and the genital apparatus. *Strahlentherapie*, 1927, xxiv, 439–458.

A preliminary report is given of the results obtained in 8 rabbits and 5 dogs. One series of experiments was conducted on 5 rabbits ten weeks old, a second on 3 rabbits seven months old and the third on 5 dogs eight weeks old. In each series the animals came from one litter and were selected for uniformity of size, weight and general condition. The hypophyseal region was irradiated from the forehead and both temples, the rest of the animal being carefully shielded. The first series received radiations from a Müller gas tube (water cooled) operated at 2 ma., the rays being

filtered through 3 mm. Al, hardness 11–12 Wehnelt, focal skin distance 25 cm. The last two series received radiations from a large metro tube operated at 180 kv., 4 ma., 0.5 mm. Zn plus 1 mm. Al, focal skin distance 23 cm. The exposed animals and controls were observed up to two or three months and then killed with chloroform, and histological examinations were made of all endocrine glands and practically all organs and bones. The details of the histological examinations are reported briefly.

A careful examination of the results of the experiments proves that the relations between the hypophysis and the genital organs are not quite so clear as claimed by many writers. Sufficient facts are still lacking to justify the assumption of a specific interrelation between the two systems. The experiments also demonstrate why attempts to produce castration by the hypophyseal route were unsuccessful. This procedure was not sufficiently founded on experimental fact.

It was demonstrated that in animals during the period of growth the partial elimination of the anterior portion of the hypophysis calls forth a series of changes in the organism characterized by general disturbance in development, metabolic disturbance (interference with growth and with weight), atrophy of the genital apparatus, etc. The degree of change was found to depend on the dose; large doses produced marked effects, smaller doses produced milder effects, and very small doses appeared to be without any effect. In some of the experiments the roentgenization caused degenerative atrophic changes in the glandular portion of the hypophysis, while at the same time the genital organs remained unaltered. The application of small doses to the hypophysis (25 to 45 per cent of the erythema dose) produced practically no macroscopic changes in the blood, but microscopically there was found an increase in the eosinophiles and in the fluid content. There were no striking clinical changes. These observations confirm the statement that irradiation of the hypophysis with small doses produces changes in the anterior portion of the gland, but there is as yet no sufficient proof for assuming that these changes are definitely indicative of a hyperfunction of the gland.

Pohle, Ernst A. Studies of the roentgen erythema of the human skin. II. Skin capillary changes after exposure to filtered roentgen rays and to ultra-violet radiation. *Radiology*, March, 1927, viii, 185–194.

The author has extended his investigations in this field to cover the behavior of the skin capillaries after exposure to roentgen rays of short wave length and to ultraviolet radiation. The skin microscope was again employed, using the technique previously described. Patients who were to receive therapeutic exposures were used, except in those cases in which ultraviolet rays were employed. None of the patients were suffering from diseases of the heart or blood vessels, nephritis, toxic goiter, diabetes or neuroses.

The dosage of filtered roentgen rays was as follows: 200 kv., 25 ma., 50 cm. focal skin distance, 0.5 or 1.0 Cu plus 1.0 Al, lambda effective 0.16 and 0.14 respectively. Erythema dose of 20 × 20 cm. equals 14 and 22 minutes, or 1,500 and 1,700 R units (measured on the patient) respectively. The parts of the body treated were arms, chest, abdomen, upper thigh, back and neck. It was observed that after the application of one erythema dose of filtered roentgen rays of short wave length, no complete recovery of small blood vessels occurs. Because some investigators have reported findings at variance with this, it seems possible that the erythema dose as given by different authors may differ in intensity. After using the erythema dose as outlined here, it is evident that there is permanent injury to the capillaries. They are usually decreased in number, elongated, walls thickened and the diameter larger. Repeated irradiations will cause even more pronounced changes. This phenomenon accounts for the late reactions following erythema doses. The results of these findings, which are illustrated with microscopic observations, may be used for controlling the erythema dose; this dose should be only strong enough so that complete recovery of the capillaries will take place within three to five months.

The capillary changes induced by ultraviolet rays, one unit, are similar to those shown following administration of unfiltered roentgen rays, except that the capillary disturbance is only temporary. Long continued treatment may, however, lead to chronic conditions. It is true that the microscopic changes in the capillaries for both types of erythema doses precede the visible skin reaction to some extent; it is, therefore, possible to predict erythema by microscopic examination of the capillaries, following administration of either roentgen or ultraviolet rays.

Politzer, G., and Sheminzky, F. On the effect of electromagnetic waves of different wave lengths upon Traube's precipitation membranes. *Strahlentherapie*, 1926, xxiii, 385–410.

Studies were made upon Traube "cells" formed by the growth of a precipitation membrane of copper ferrocyanide. Roentgen rays in therapeutic doses produced no noticeable change in these membranes. By warming the solution in which these membranes were produced, the normal process of growth could be accelerated and by cooling it could be retarded. Irradiation with visible and ultraviolet rays was found to produce a characteristic change in these "cells." The color of the membrane became an intense gray green yellow as against the reddish brown of the normal. In addition, the growth of the membranes was inhibited and their degeneration was apparently prevented. The membranes exposed to the light showed under the microscope a peculiar type of crystal formation suggesting an increase in the number of points of crystallization due to the illumination.

The permeability of the Traube membrane changes with its age. When it is in a fluid phase it is practically impermeable; when freshly solidified it is semipermeable, and when old it is completely permeable. The changes in growth of the membrane observed in these experiments appear to be due to alterations produced in the permeability and not to incidental changes in solubility and diffusion.

One of the striking observations reported is to the effect that rays of different wave lengths induce different and oftentimes opposing effects. Although the subject has not been exhaustively studied, it is nevertheless strongly suggestive that opposing effects by different rays may occur in the living as well as the nonliving system, and this suggests a revision of the current opinion regarding the nonspecific action of roentgen rays.

Pugno-Vanoni, Enzo. Antidiffusing screens for protective purposes in roentgen-ray treatment. *Radiol. med.*, Sept., 1927, xiv, 782–788.

A screen that is opaque to roentgen rays diffuses a remarkable amount of energy from the surface exposed to irradiation, the nature of the diffused rays depending on the material of the screen. The lower the atomic weight of the material of the screen the softer the secondary rays. For the purpose of obtaining screens opaque to roentgen rays which emit only a few secondary rays the author proposes making screens with layers of different material with increasing atomic weights, arranging them in the direction of propagation of the rays. The correctness of this theory and the fact that there is an optimum thickness for each layer of which the screen is composed has been shown by experiment. With ordinary screens it is necessary to enclose the tube completely in an opaque envelope. Bodies that are very opaque to roentgen rays are very poor insulators of electricity so that it requires an enormous size and weight of material to enclose the tube completely.

But by using an antidiffusing screen such as that proposed by the author it is possible to meet the electrical requirements and afford protection both within a comparatively small volume, as it is possible to intercept the direct rays from the tube by means of metallic screens and suppress the small amount of secondary rays from the latter by means of bodies which are slightly opaque to roentgen rays but very good insulators of electricity. The author has had tube protectors made according to these principles equivalent in opacity to roentgen rays to 3.5 lead. These protectors, insulated at 250,000 volts, also improve the distribution of the electrical field around the tube and allow it to be placed in any position.

Rachmanow, A. On the effect of roentgen rays on the central nervous system. *Strahlentherapie*, 1926, xxiii, 318–325.

Studies were made on white mice which received a 1 per cent solution of trypan blue in order to vitally stain the tissues. Injections of 0.5 c.c. were made every five to seven days, the total quantity received by each animal being 2.5 to 3.5 c.c. of the dye solution. A part of the solution was injected before roentgenization and the rest afterwards. The animals were roentgenized as follows: The four extremities were fastened, the head rendered immovable, and all trauma avoided. The roentgen rays were delivered only to the head, the rest of the body being carefully protected with lead rubber. The rays were produced by a Coolidge tube, operated at 2 ma., focal skin distance 23 cm., no filter.

A careful examination was made of the brain and spinal cord preparations but no changes were found as to the vital staining of the ectodermal elements. There was also no difference between the nerve and glia cells of irradiated and control mice. The only difference noted as a result of irradiation of the head was an increase in the vitally stained histiocytes and in the occurrence of blue-colored droplets in the endothelial cells of the blood vessels. Examination of the cord from animals receiving irradiations of the head showed essentially the same results, viz., (1) the vitally stained histiocytes in the vascular walls both in the white and in the gray substance were more numerous than in the control; (2) in the vascular endo-

thelium there appeared light blue droplets. It may however be mentioned that the difference in the spinal cords of the irradiated and control animals was not so sharp as in the brains. Examination of the internal organs yielded nothing definite because the staining of the cell elements was not uniform.

In some animals an exposure was made over the tail and hind leg instead of over the head, the same dose being used. A very careful microscopic examination of the brain and cord showed no increase in the number of vitally stained histiocytes nor the appearance of the blue droplets in the endothelial cells. This experiment shows clearly that the changes found in the brain as a result of exposing the head are due to a local effect of the rays. The conclusion drawn from the above experiments is that the reticulo-endothelial apparatus of the central nervous system responds both to trauma and to roentgen rays in exactly the same way. Emphasis is laid on the fact that the differences in the vital staining here reported are not found uniformly throughout the brain, but develop only in certain areas.

Rajewsky, B. The Compton effect under conditions of deep therapy irradiation. *Fortschr. a. d. Geb. d. Röntgenstrahlen*, 1926, xxxv, 262–269.

A brief summary is given of modern theories regarding the absorption and dispersion of short wave radiation and a discussion is also presented of the important aspects of the Compton effect in relation to deep therapy. The author has undertaken new measurements with the aim of examining the Compton effect under the conditions of deep therapy raying. Under these conditions when a sufficient intensity is employed there occurs a multiple scattering which is about three or four fold depending on conditions. Higher degrees of scattering occur also but their intensities become progressively smaller so that within certain limits they have no practical significance. Corresponding to this multiple scattering there is present a multiple Compton effect. Through this not only are the wave lengths changed in the radiation mixture in the strict sense, but also the whole quality of the radiation (its composition) in the therapeutic sense. The magnitude of the wave length alteration depends upon the position of the particular point and the conditions of irradiation.

This has an important application in practical dosimetry. It has often been recommended that the dose be measured only in the beam of incident rays. It is clear, however, that this sort of measurement gives no index at all of the qualitative and quantitative aspects of the radiant energy acting directly on a tissue and scattering to produce still further effect. Satisfactory physical dosage demands a physical measurement at the site of action of the rays.

Rankin, J. O. A new fracture table to be used in conjunction with the fluoroscope. *J. Bone & Joint Surg.*, July, 1927, ix, 447–449.

Description is given of a table devised for the reduction of fractures of the lower extremities under the roentgenoscope and for the maintenance of the corrected position until the cast is applied. It is constructed of a movable, rigid, stretcher-type base on which are built extension bars. It is very light and can be easily lifted with the patient on it from the hospital carriage to the roentgenoscopic table. The shoulder and head piece is movable to accommodate the patient or make room for the hip spica. The extension bars are made of steel, are adjustable and are double so that they do not interfere with the roentgenoscopic view of the bones. The foot pieces are set at a comfortable angle for the foot and are removable. The heel pieces are also removable. When the foot is in place, it is about 6 inches above the extension apparatus making it quite easy to apply plaster around the foot and ankle while extension is being applied.

Reiss, P. A physico-chemical action of the roentgen ray on the organism. *Compt. rend. Soc. de biol.*, 1926, xcv, 353–354.

The effect of irradiation on muscles of the mouse were determined under the following conditions: the dose was 4,000 r, corresponding to irradiation of forty minutes with 3 ma., under potential corresponding to 40 cm. e. e., Coolidge tube in oil, unfiltered. This dose was tolerated by the mice treated. After varying intervals, they were killed and the isoelectric point of the muscles of the thigh determined by cataphoresis in buffered solutions of varying hydrogen ion concentrations, following the technique of Vlés and Coulon. The isoelectric point began to rise in the first hours following irradiation and reached its maximum after two days. These observations are of deep interest from the standpoint of the physiochemistry of the cells.

Rigele, Hermann. Technique of ray-protection in therapy and diagnosis. *Strahlentherapie*, 1927, xxiv, 762–765.

Three different aspects require attention: (1) the rays escaping from the roentgen tube

to the side and rear must be eliminated; (2) scattered radiation arising from material penetrated by the rays must be rendered non-injurious, and (3) the rays after passage through the patient's body must be screened off.

Under modern conditions of diagnostic practice, the all-metal protected tubes produced by the Philips Company seem to eliminate many of the dangers from stray radiations. The use of lead glass of a higher lead content introduced recently is another noteworthy advance. For radiation therapy, considerable effort must be exerted to prevent scattered radiations from accumulating in injurious quantities. Most of the commercial devices in use in Germany are not entirely free from this hazard.

RÖVER, W. Arrangement for the standardization of the Fürstenau intensimeter. *Strahlentherapie*, 1926, xxiv, 368–371.

The Fürstenau intensimeter for determining the dose of roentgen rays depends for its action upon the change in electrical resistance of the selenium cell interposed in the path of the radiation. The selenium cell forms one branch of a Wheatstone bridge, and change in its resistance is indicated by a galvanometer. Variations in the instrument itself owing to changes in resistance of the selenium cell and temperature and other effects on the circuit cause a disadvantage in that the readings of the intensimeter must be checked from time to time.

A convenient method for checking the instrument is the employment of a standard source of visible light; and the details of the procedure are described.

SALVATORI, G. B. Autoprotective roentgen tubes for diagnosis. *Arch. di radiol.*, Mar.–Apr., 1927, iii, 455–457.

The author made experiments in his laboratory with the Müller autoprotective tube which consists essentially of a cylindrical ampule of a diameter of about 4 cm. constructed like the "Media" type with a Götze linear focus and placed in a "Pertinax" cylinder lined on all sides with anti-roentgen substance with a protective value equivalent to that of 2.5 mm. lead. The bundle of rays comes out at a window in front of the anticathode. The experiments showed that this tube furnishes complete protection.

SCHALL, L. The skin erythema problem. *Strahlentherapie*, 1926, xxiii, 354–360.

For estimating the stimulatory response of the skin to roentgen irradiation, it does not suffice merely to measure at certain intervals (for instance, in the third and sixth weeks) the intensity of erythema or pigmentation. A more complete and satisfactory picture is obtained by a study of the whole course of the reaction. The individual variations in intensity of the erythema and also of the pigmentation appear to be so great that there seems no hope at present for obtaining a true explanation of the relation between physical dose and the skin erythema dose from the measurements of definite degrees of erythema or pigmentation or of a typical reaction to the rays. Small differences in dosage up to 20 per cent of the skin erythema dose are sometimes hardly apparent even when measuring the course of the reaction. There exists no more constant relation between the threshold value and the physical dose than between the latter and the course of the reaction.

SCHMIDT, WALTHER. On the biological effect of roentgen rays. *Strahlentherapie*, 1926, xxiii, 681–686.

It appears that the curative effect of roentgen rays on the blood plasma does not merely balance the resulting damage to the red and white blood elements but really overbalances them. This conclusion is based on experiments designed to disclose the effect of roentgen rays upon the positive or negative indications of serological reactions. The reaction tested was the Lüttge-v. Mertz alcohol extract reaction. Five c.c. of the serum was irradiated with 1, 2, 3, or 4 skin erythema doses, delivered at 250 kv., 3.5 ma., filtered through 0.5 mm. Al, focal distance 23 cm. The serum was irradiated in test tubes and in open Petri dishes. Of 10 normal sera, 9 remained negative before and after irradiation; one serum was hemolytic and reacted positively both before and after exposure. Among the sera of gravid women, all 10 remained positive after exposure to 1 skin unit, 7 remained positive after 2 skin units, 2 after 3 skin units, and all turned out negative after exposure to 4 skin units. Of 10 carcinoma sera, all remained positive after 1 skin unit, 8 after 2 skin units, one after 3 skin units, and all were negative after exposure to 4 skin units. These results showed a distinct parallelism in the physical-chemical changes of the serum occurring in the *in vitro* experiments and in the living organism. The underlying cause for the change in the reaction is at present unknown but the experiments indicate quite clearly that roentgen irradiation produces as yet unknown changes in the serum protein or the blood lipoid.

Schneider, Erich. Experimental studies on influencing starch breakdown by roentgen rays. *Strahlentherapie*, 1926, xxiii, 326–335.

The author sought to repeat the work of Haehn and Biedermann in an attempt to cause, by exposure to roentgen rays, a decomposition of starch in the absence of enzymes. The results of these authors could not be confirmed, and a non-fermentative decomposition of the starch could not be demonstrated. An action of the roentgen rays could not be shown either through irradiation of the starch alone or by irradiation of the starch mixture containing reagents. This result was no more than would be expected, for it must be assumed that the roentgen rays traversing so large a molecule as that of starch would simply shoot through without effect; and from a purely physicochemical viewpoint an effect would be highly improbable.

Schneider, Georg H. Roentgen doses in absolute r units. *Strahlentherapie*, 1926, xxiii, 463–487.

An attempt is made to give the absolute values of depth doses under varying operating conditions. It is emphasized that the physical dose should consider not only the value of the primary beam of rays but also the value of the total superficial dose. This consists of both the scattered radiation and the primary beam. The precipitation of scattered radiation and of the total superficial dose and the amount of scattered radiation to be added to the primary dose must be determined dosimetrically. Depth doses can be determined only from the total superficial dose. The author's experience confirms the view of Grebe and Martius that the skin erythema dose equals 600 r of primary impinging radiation. Numerous tables are given indicating the dosage under various operating conditions for producing complete or temporary menostasis in women of different age periods and with myomas of different size.

Schneider, Georg Heinrich. A new field illuminator for the roentgen-ray cone with luminescent screen visible by means of oblique insertion. *Strahlentherapie*, 1927, xxiv, 560–563.

A description is given of a field illuminator for determining the boundary of a beam of rays. Its novelty lies in the new arrangement of the luminescent screen. The latter is inserted in the frame of the field illuminator obliquely from back to front in such a manner that the field outline may be observed in the true plane perpendicular to that of the beam. The whole surface of the luminescent screen is visible.

Schneider, Georg Heinrich. Increase in accuracy of roentgen-ray measurements by the iontoquantimeter. *Strahlentherapie*, 1927, xxiv, 715–718.

Operation of the iontoquantimeter requires the avoidance of any rotation of the measuring instrument while it is charged. Small rotations about the axis of the conductor are practically unavoidable during the charging of the instrument. As a consequence the results of the readings are affected by an error which may be appreciable. In order to avoid introduction of errors due to variable mechanical conditions of operation, it is recommended that the iontoquantimeter be furnished with a level and be mounted on a universal joint. The perfectly level and vertical adjustment of the instrument during operation by means of a small water level seems to be absolutely necessary.

Schreus, Hans Th., and Schoenholz, Ludwig. The skin tolerance dose in roentgen units for various wave lengths. *Strahlentherapie*, 1927, xxiv, 485–500.

Previous observations of Schreus confirm the findings of Fricke and Glasser that with hard zinc-filtered rays a 50 per cent increase of a dose producing medium erythema causes a maximum reaction of the blood vessels, that is, a distinct injury. Experiments show quite definitely that soft rays require a considerably greater number of r units than do hard rays for the production of a medium degree of erythema. The authors have determined empirically by employing a color scale that the erythema reaction can be differentiated with sufficient sharpness to determine equivalent erythema doses produced by rays of different hardness. This procedure is especially of use when the reaction is checked by observing the point at which maximum dilatation of the blood vessels is produced.

In the concept of tolerance dose there are a number of points to be considered. An important one is the matter of ray hardness and field size. The authors have determined erythema curves for radiations produced at 125, 150 and 210 kv. and established the erythema dose in r units. In contrast to reports of other investigators it was found that the erythema dose is dependent on the ray hardness, hard rays requiring a smaller number of r units to produce an erythema than do soft rays. For a homogeneous hard therapy radiation (210 kv. and 0.5 mm. Cu plus 1 mm. Al), the authors suggest for the skin tolerance dose a value of 500 r.

Schubert, Martin. The question of the biological action of roentgen rays and its study by the explantation method. *Strahlentherapie*, 1927, xxiv, 551–554.

Experiments were made to determine the time at which a distinct roentgen-ray effect could be demonstrated in the heart tissue of a chick embryo which was irradiated *in ovo* and removed at definite time intervals and explanted into an unexposed culture medium. The results showed that heart tissue explanted two hours after irradiation *in ovo* exhibits the first signs of growth inhibition in tissue culture. Explantation three hours and more after irradiation was unsuccessful, the tissue failing to grow. Healthy pieces of heart tissue explanted into embryonic extract of animals frozen *in ovo* three hours previously showed no signs of growth inhibition. And in the extract of animals irradiated *in ovo* three hours previously there showed only in one case a very slight retardation in growth. Explantation in extract of embryos frozen twenty-four hours previously resulted in a pronounced inhibition in growth; and with animals receiving a lethal irradiation *in ovo* twenty-four hours previously their extract would not support the growth of a tissue culture. This seems to show that the biological effect caused by irradiation or freezing of incubated eggs is transferable to the embryonic extract, the differences, if any, being quantitative and not qualitative. This seems to be confirmed by the incidental observations that the intensity of growth of the cultures was in inverse relation to the degree of hemolysis in the extract.

Schultzer, Poul. Experimental investigations into internal radium emanation therapy. II. On the cause of the effect on rats of continuous emanatorium treatment. *Acta radiol.*, 1926, vi, 647–657.

On introducing paraffin capsules containing from 0.04 to 0.20 gm. of a radium bromide solution (strength 15 to 20 mg. per cent) into the peritoneal cavity of rats, a state of equilibrium was reached in which the animals steadily excreted the amount of radium emanation produced. The amount of radium emanation eliminated per hour was determined by allowing the animals to eliminate the radiation into an electroscope. A direct proportionality existed between the radium bromide content of the capsule and the amount excreted. The end-result of this experiment was that the rats contained a constant amount of emanation. The latter was estimated by removing the capsule from the narcotized animal and then letting it get rid of the emanation. A direct proportionality was also found between the strength of the capsule and the emanation content per gram weight of the rat (saturation value).

By introducing capsules of suitable size, a saturation value was obtained in the rats which was greater than the saturation value in those which were kept permanently in an emanatorium containing 2000 Mache units per liter; that is to say, rats which would have succumbed in the course of four to five weeks according to previous findings. These "capsule" animals were observed for nine weeks and no difference was seen between them and the corresponding control animals. It is concluded from this that the emanatorium rats did not succumb because of the contained emanation but probably as a result of the hard radiation which bombarded the animals externally. The elimination time for the emanation was also determined. For young rats of about 40 gm. this interval was about two minutes. For larger animals it was longer.

Singer, S. A new method for filter safety and the ventilation of the roentgen tube during therapeutic irradiation. *Fortschr. a. d. Geb. d. Röntgenstrahlen*, 1926, xxxv, 240–242.

A device is described which it is claimed makes it impossible to irradiate when the filter is omitted. The raying window is covered as long as the filter is missing with a sheet of brass held in place by springs. When the filter is inserted the brass guard plate must be pushed aside. The ventilation scheme proposed by the author utilizes the smoke stack principle. Lateral openings are provided in the protective cylinder so that cold entering air can displace the heated contaminated air inside the chamber and thus out of the chimney. Special guard strips are provided around the lateral openings to prevent leakage of roentgen rays.

Solomon, Iser. Necessity for standardization of the ionization chamber used in dosimetry. *J. de radiol. et d'électrol.*, May, 1927, xi, 286–290.

Small ionization chambers cannot be standardized from large ones on account of the fact that the current of ionization registered in the small chamber depends on the wave length. Compton has shown that the wave length of secondary irradiation is not the same as that of the incident ray. Attempts made by different authors to devise a small ionization chamber that would be independent of wave length are described. Fricke and Glasser propose an ionization chamber with walls made of a mixture of 100 parts of graphite and 18.6 parts of

magnesium, the magnesium being arranged in a thin layer inside the wall; the atomic value of this chamber is equal to that of air. They say that a small chamber made in this way does not need to be standardized with a large one but can be standardized directly in electrostatic units. The author thinks that this chamber or a small one that he has had made with walls of graphite and a volume of air of 1.810 c.c. give values that are sufficiently independent of wave length so that standardization with a large chamber is not necessary.

In order to bring about international standardization it would be necessary for the different nations to adopt some such standard chamber and to come to an international agreement on the value of the quantometric unit R.

Stoklasa, Julius. Lactic acid as an intermediate product of anoxybiotic carbohydrate metabolism in the animal cell. *Biochem. Ztschr.*, 1927, clxxxiii, 461–476.

Experiments show that in the anoxybiotic respiration of muscle cells lactic acid appears as the first poduct of carbohydrate metabolism. Alcohol and CO_2 are formed from the lactic acid; and the alcohol yields acetaldehyde and acetic acid with the liberation of more CO_2. Under the influence of alpha and gamma rays, the quantity of CO_2 decreases, especially under gamma radiation, while that of lactic acid becomes much more considerable. It was also found that the alpha rays of ionium very greatly increase the oxidative phase of the cell metabolism and cause almost complete disappearance of the lactic acid. This effect was also found for radium emanation.

Strauss, Siegmund. The "Mekapion," the integrating roentgen dose calculator with automatic control. *Strahlentherapie*, 1926, xxiv, 348–364.

A description is given of a new apparatus in which an electron tube is employed as a controlling mechanism. The occurrence of a current in the anode circuit actuates a relay and contact in this circuit. Exact and precise maintenance of the filament and anode currents is not necessary. The strength of the anode current operating the relay can be made sufficiently strong so as to give assurance that the action will be sufficiently positive. Another feature of the hookup is the avoidance of high resistances in the grid circuit.

The device was named "Mekapion" because it was designed for the measurement of high resistances (megohms), capacities and ionizations. The original must be consulted for details as to construction, wiring and operation.

Strauss, Siegmund. Practical dosimetry with the Mekapion. *Strahlentherapie*, 1927, xxiv, –757526.

The "Mekapion" is an automatic, integrating roentgen dosimeter. It operates as follows: The air in an ionization chamber connected with a small well-insulated condenser becomes conductive under the influence of the roentgen rays. The very minute current produced discharges the condenser from a definite upper level to a pre-determined lower potential. The highly insulated pole of this condenser is connected to the grid of an amplifying tube which functions in this case as a valve tube, i.e., when the grid is charged strongly negative with respect to the cathode no current can flow through the bulb, but when the grid is uncharged or has a charge of a few negative volts a current flows in the bulb. In the latter case, a relay in the anode circuit closes the local circuit of a recorder whereby the pointer of the latter moves up one graduation. At the same time a potential discharge is released in a small autotransformer so that the ionization chamber and the small grid condenser are recharged to the original high negative potential. The graduations on the recorder may be calibrated in terms of R units and the whole operation may be made automatic. Certain obvious applications of the "Mekapion" are discussed.

Stumpf, Pleikart. Rod vision in roentgenoscopy. *Fortschr. a. d. Geb. d. Röntgenstrahlen*, 1926, xxxv, 260–261.

The most important fact regarding vision in the darkened room is that the central scotoma is not observed in all the cases in which a major portion of the field of vision is filled with shapes. The scotoma is smoothly filled in in a manner quite similar to that ordinarily taking place in the case of the blind spot. Only when the peripheral portions of a 30 cm. field are cut down to 2 cm. (about 3°) does the scotoma interfere with a direct perception of shapes. This peculiarity is apparently due to the fact that the forms observed in roentgenoscopy are as a rule fairly large and a certain survey is necessary in order to perceive the object studied.

Thaller, Rudolf. What requirements must radiation protection tubes fulfill absolutely in order not to be of danger to the physician and assistants? *Fortschr. a. d. Geb. d. Röntgenstrahlen*, 1926, xxxv, 85–89.

Stray, scattered rays escaping from the tube must be absolutely eliminated. Consequently any device going under the name of ray protection tube should be able to absorb all such scattering; and it would be better not to use such devices unless they completely fulfill this requirement, otherwise they may give a sense of fancied security which might result in serious injury. The author describes a device for testing the reliability of such protection tubes. This consists of a frame upon which are placed photographic films from which may be determined the degree of protection offered by the instrument.

TOULANT. Eye lesions in actinotherapy and their prophylaxis. *J. de radiol. et d'électrol.*, Apr., 1927, xi, 198–202.

The ultraviolet rays are responsible for the majority of the eye lesions seen in actinotherapy and in industry. They affect the cornea chiefly, causing a superficial desquamation of the corneal epithelium which exposes the nerve terminals and produces acute pain and intense photophobia. The eyes of both patient and physician should be protected against the action of ultraviolet and infra-red rays. The lamp should be masked by an absolutely opaque reflector and doctors and nurses should wear dark glasses. Most of the eye lesions from actinotherapy are benign so the patient who fears injuries comparable to those from roentgen rays can be reassured. Ultraviolet keratitis is very painful and the chief indication is to control the pain, which can be done by the instillation of cocaine. The only serious lesions are those caused by the infra-red rays which may bring about cataract. The infra-red rays do not injure the retina or the optic nerve.

VOGT, E. Comparative studies of the stomach of the newborn on the basis of roentgenograms and stearin casts. *Fortschr. a. d. Geb. d. Röentgenstrahlen*, 1926, xxxv, 427–435.

Stearin casts were made immediately after death of the newborn in order to avoid post mortem changes in shape. An examination was made of 15 newborn infants and fetuses, from the thirtieth to fortieth fetal week. These cases are pictured and briefly cited. The stearin cast method of studying the stomach was found to be very satisfactory, and these studies confirm and extend the results obtained by roentgen examination with contrast meals. The confirmation extends to the anatomy, topography and physiology of the stomach. The method has also proven valuable in the study of the ontogeny and anatomy of the gastric canal.

VOLTZ, FRIEDRICH. A timing recorder for irradiation purposes. *Strahlentherapie*, 1927, xxiv, 564–568.

The roentgen-ray dose may be determined either directly or indirectly. The direct method for determining when a definite dose is attained is determined by means of a suitably calibrated dosimeter on the patient during the irradiation. The indirect method utilizes the time factor alone after roentgen apparatus and tubes are calibrated by means of an exact dosimeter for output for different time intervals. Hitherto an alarm clock arrangement has been used for the indirect method but certain disadvantages in its use were encountered. The time of exposure was noted by attendants and entered in the patient's record, but this allowed opportunity for intentional or unintentional carelessness and possibility for inaccurate dosage. By use of the recording timer the exact duration of treatment is automatically recorded and can be made a part of the patient's history.

v. PANNEWITZ, G. Action on the acid base balance by roentgen rays. *Strahlentherapie*, 1926, xxiv, 327–330.

In vitro irradiation of pus and urine gave no very satisfactory results. The exposures of blood serum caused change in hydrogen ion concentration approaching the value of the ioselectric point. Experiments were also made on the hydrogen ion concentration and alkali reserve in the blood in irradiated humans and rabbits. The results in both species were essentially the same. The changes in hydrogen ion concentration were very slight, but the variations in alkali reserve were much greater. The reaction showed two phases, one immediately after the irradiation took the form of an acidosis or a hypocapnia. This was gradually neutralized in two to five hours by a slowly increasing alkalosis which persisted for several days.

There seems to be a definite dependence of the magnitude of the reaction upon the region of the body irradiated. The effect increased in the following order: extremities, female genitals, thorax, abdomen. Another important observation is the fact that the degree of the response is dependent on the irradiated organ. After irradiation of the extremities the response is so very mild as to fall within the limits of error of the determination. The same may be said for the irradiated female genitals, except that the two-phase nature of the reaction is quite distinct. Irradiation of the mediastinum causes a very definite effect but the greatest

reaction follows irradiation of the abdominal organs.

Attention is directed to the fact that vagal stimulation has something to do with roentgen sickness which is always found to occur in the second phase of the reaction to the radiations. This suggests the possibility of controlling roentgen sickness. Irradiations of the liver cause a different reaction. In all cases of liver disease there is considerable decrease in the alkali reserve and roentgenization of the liver causes a further pronounced increase of the acidotic phase and decrease or complete absence of subsequent alkalosis. This is believed to be due to a direct effect of the rays upon the liver metabolism.

Watrin, J. The comparative action of roentgen rays and the ultraviolet rays on the development of the larvae of *Rana temporaria*. *Compt. rend. Soc. de biol.*, 126, xcv, 189–190.

Young tadpoles were subjected to the action of roentgen rays and ultraviolet rays in order to determine the effect on their development. One lot was placed 16 cm. from the anticathode of a Coolidge tube and received 10 H, without filtering; during the fifteen days which followed no effect whatever was noted in the tadpoles. Even stronger doses did not affect their development, except that many of them showed a more rapid metamorphosis than the controls. There were other factors which may have caused the more rapid development of some of this lot, and it cannot be said that the roentgen rays were alone responsible for it. A second lot was subjected to the rays from a quartz lamp, in which the ultraviolet rays were directed to the tadpoles at a distance of 80 cm. for ten minutes. The tadpoles exhibited very rapid motion, which increased activity was due to the effect of the rays. When these irradiations were repeated at five-day intervals, after the third treatment a loss of weight and pigment was noted; after the fifth treatment most of the tadpoles were dead. If the quantity of water in which the tadpoles were held during treatment is decreased so that only the ventral portion is submerged, irradiation with the ultraviolet rays for only twenty minutes was sufficient to kill them. The very marked effect of the ultraviolet rays is in marked contrast to the lack of effect by the roentgen ray, which is of much significance.

Wintz, Hermann. The Compton effect in deep therapy. *Strahlentherapie*, 1926, xxiv, 218–226.

Experience shows that there is no parallelism between the skin reaction and air ionization for different ray qualities. This is explained as due to the action of Compton electrons, which are responsible in a considerable degree to the air ionization by hard radiations, whereas in the scattering process no molecular excitation occurs, the latter being a requisite for the action of the rays. If air ionization is chosen as a fundamental basis, then a very considerable complication is introduced in the problem of dosage because a reaction dependent on wave length is referred to another reaction dependent in a different way on wave length. A reliable basis would be the measurement of the heat generated by complete absorption of the radiation. Measurements hitherto employed for determining the heat effect of roentgen rays are not entirely free from objection and the author suggests a procedure which may possibly be satisfactory.

The change in wave length occurring during scattering is of importance in the effectiveness of hard rays, and the author presents a theoretical discussion tending to explain the greater effectiveness of soft rays over hard rays.

Zacherl, H. On the general effect of roentgen rays. *Strahlentherapie*, 1926, xxiii, 272–287.

In the white rat three hours after irradiation there is a distinct increase (almost double) over the original value of white blood cells, this increase persisting however only a short time. At the fifth hour there occurs a distinct drop in the leucocyte number. The decrease continues fairly rapidly and drops in many instances to 500 leucocytes per cubic millimeter. The differential count, especially during the period of leucocytosis, shows a striking increase in the polynuclear leucocytes at the expense of the lymphocytic elements. This is followed shortly after by a mild relative increase of the large lymphocytes and eosinophiles.

Following these experiments on individual animals, the author made experiments on parabiotic animals joined by a celiac anastomosis. White rats weighing 150 to 180 gm. were employed, the irradiations being given fourteen days after the operation. The rays were produced by a Symmetrie apparatus, 2 ma., 38 to 40 cm. parallel spark gap, focal skin distance 23 cm., time of exposure 40 min. This exposure to an animal led to death in three to four days. In the case of the parabiotic animals, one individual was exposed to the rays, the other being protected. It was found that the unexposed animal exhibited the same leucocytic response as the irradiated animal. The same was observed for the temperature drop. In those instances where the dose was fatal for the exposed animal, the joined

animal died at the same time or one hour after at the latest. The only observed clinical difference in the response of the two animals was that the unirradiated animal had no diarrhea and showed no intestinal symptoms. These experiments seem to indicate that roentgen rays cause the production of some toxic substance capable of producing sickness and death in the animal.

Other experiments seem to indicate that the electrical charge of the organism and the action of poisonous gases arising during irradiation are of no important significance in the occurrence of roentgen intoxication. Enzyme studies revealed an increase in peptidase only in the late stages, while in the first few days after irradiation there was a slight decrease in the peptolytic index. This absence of a higher index in the face of an early direct cell injury is very striking and raises the suspicion that roentgen rays might have caused destruction of enzyme. An attempt was made to confirm this suggestion but the results of the experiments were indefinite.

ZELLER, HEINRICH. The effect of medicaments and rays upon yeast. III. The effect of roentgen rays upon yeast. *Strahlentherapie*, 1926, xxiii, 336–353.

The author demonstrates that it is possible to produce an effect upon dried baker's yeast by exposing them to roentgen rays. This effect is shown in a retardation of the CO_2 production. This retardation is relatively slight except for long exposures, and the yeasts recover rapidly. After several hours even the most heavily irradiated specimens show no inhibition of their fermentation powers. Experiments are cited showing that irradiated sucrose is reduced somewhat more vigorously than the nonirradiated. Yeasts in a sugar solution are stimulated in their CO_2 production by small roentgen doses; larger doses produce a retardation more pronounced than that occurring in irradiated dry yeast. Both the stimulation and retardation are only temporary. The effects of added electrolytes of various kinds were also studied. The results of all the experiments may be summarized as follows: Roentgen rays produce a latent change in the condition of the cells, which is evidenced by an increased sensitiveness. The zymase within the cell behaves fairly independently of the condition of the cell and is not affected by the irradiation.

ZWAARDEMAKER, H. Radiation with soft radium rays and automaty (automatic heart beat). *Nederl. Tijdschr. v. Geneesk.*, 1927, lxxi, Part 1, 3381–3394.

The isolated frog heart stops beating when one-third of the potassium content of its perfusing fluid is removed; and it resumes beating when this is replaced by other radioactive elements such as uranium, thorium, radium, polonium or radon. The amounts of these elements required correspond to their radioactivities. Numerous experiments are cited to show that radioactivity and biological activity are proportionally related.

About one micro-erg of radioactive energy is consumed in the normal heart per gram per second. Potassium deficiency can also be replaced by alpha and beta radiations. Only radiation which is absorbed by the myocardium will act, hence only soft rays are effective. Filtration of the radiations through aluminum destroys their biological action. Gamma rays or hard beta rays are inactive. The heart resumes its beat following irradiation after a very long latent period, varying from one-half to two hours according to the distance and strength of the radiating preparation. This suggests an indirect action of the radiation. In agreement with this is the large after-effect noted, for instance, a perfusing fluid which is once irradiated while passing through a heart will also cause a second heart to beat again even in the absence of direct radiation. The author believes that this is due to the formation of active substances, "automatines." These hormones are very soluble in water, are not decomposed by boiling, are diffusible through collodion and are adsorbed by charcoal or magnesium silicate. They are produced by the radiation from a mother substance having similar properties.

BARDEEN, CHARLES R. The use of radiology in teaching anatomy. *Radiology*, May, 1927, viii, 384–386.

A knowledge of anatomy is of such fundamental importance in roentgenology that it need not be mentioned, and by this is meant a more thorough study of the subject than is necessary for the general practitioner. On the other hand, roentgenology can be and is a most helpful aid in the study of anatomy. By this means it is possible to illustrate the normal in the living much better than is obtained in the cadaver. While roentgenograms are of very great importance in the teaching of anatomy, the roentgenoscope is of even more value. Roentgenograms and films may be used by the instructor in anatomy for illustrative purposes, but an instructor trained in roentgenology should be present when the roentgenoscope is used. The author then gives examples in which roentgenology has helped in the teaching of normal anatomy, in which roentgenograms of the viscera are

shown in various postures and positions. The relative positions of the different parts of the digestive tract and organs of the viscera are noted for different positions and postures of the individual. This is but one of the many uses of this excellent aid in the study of anatomy.

Blaine, Edward S. The teaching of roentgenology to undergraduates. *Radiology*, May, 1927, viii, 374–378.

This paper represents a plea for the inclusion of a course in radiology in the undergraduate curriculum in our medical schools. Such courses are offered by a few schools, but even these could be improved, and the author makes suggestions to this end. It is not enough to show students films of clinical cases, with the interpretation of the instructor, but he must be given instruction in the fundamentals of the subject and taught to recognize for himself abnormalities which are being illustrated. To do this it will be necessary to give a short presentation of the physics of the roentgen ray, instruction in roentgen-ray diagnosis in which the student will learn to appreciate the small differences of the shadows in the films and learn to evaluate them properly; instruction as to the therapeutic value of the roentgen-ray treatment of diseases, superficial and deep. This instruction should be given prior to the student's clinical studies, that is, before the beginning of his senior year. This should require at least a total of one hundred hours, including instruction in all the phases outlined here. To do this properly the medical school should be well equipped with its own films and lantern slides so that lectures can be given with the maximum of benefit to all. These slides should be obtained from clinical material by the roentgen department of the school. Before presenting the abnormal, the students should be well-grounded in the normal. The material covered should not be too extensive, yet it should be thorough, and still it should not be so detailed as to be made complicated. These courses are not meant to be for those students who are to make a specialty of the subject, but rather for the information of the regular students who intend to go into general practice.

A brief outline is suggested for clinical study under the following general heads: bones and joints; head; respiratory tract; mediastinal (excepting esophagus); cardiovascular; the digestive tract; urinary tract; and therapy. In this course, the instructor must not emphasize matters of technique, dosage, etc., which are properly left to the expert roentgenologist. The course is not for the specialist, but information for the general student, teaching him what to expect and what not to expect of the roentgen ray when he has need of it in his practice.

Cameron, William H. Easy method for making surface casts to hold radium tubes in position. *Radiology*, May, 1927, viii, 438.

The author uses a powdered molding compound which he incorporates with gauze strips, as is ordinarily used with plaster-of-Paris, heats slightly over a hot plate and molds to parts. The number of strips used depends on the thickness desired, or rather the distance the radium tube is to be held from the lesion or skin surface. This makes a light, strong cast and holds radium tubes in exact position without the use of adhesive plaster. It becomes harder than the ordinary molding compound, will not stick to hairy parts and is not brittle. This method cannot be used in the mouth.

Cantrell, Thomas D. A simple method for knowing the face of a plate taken in a cassette. *Radiology*, May, 1927, viii, 439–440.

The writer stamps his name on the film just opposite from the ordinary stamp, the impression from it reading backward. With cassette lid up and face down, the name is stamped on the intensifying side, reading backward. The name will then read correctly when the film is developed. This is of particular value in detecting right and left sides of films after developing.

Clark, James J. Undergraduate instruction in roentgenology. *Radiology*, May, 1927, viii, 394–397.

The author compares first the kind of instruction he obtained in roentgenology as a student with the courses given now in Emory University Medical School, and notes a very remarkable progress. As a result of this advance in methods of teaching this subject, the students are prepared to interpret roentgenograms and to recognize the value of roentgen-ray therapy; to understand pathologic roentgen demonstrations and appreciate the value of roentgenologic study of various abnormal conditions; to take proper precautions when making use of the roentgen ray in its various capacities, etc. The author is enthusiastic about the present value of instruction in roentgenology to undergraduates and makes a plea here for greater interest in perfecting these courses in all medical schools.

Desjardins, Arthur U. The analgesic property of roentgen rays. *Radiology*, April, 1927, viii, 317–329.

A review of the literature shows that the

analgesic effect of the roentgen ray has been widely noted and, although of only secondary interest to most physicians and roentgenologists, this property is nevertheless of much importance. In many cases the roentgenologist has considered such an effect the result of the benefit derived by roentgenotherapy and not as a direct effect. In other cases when analgesic effect has been expected and has not followed roentgenotherapy of certain conditions, this failure has been due to the fact that the treatment has not been directed properly or that the pain was not amenable to roentgen rays. Seven case reports are given in which this property of the roentgen ray is illustrated. In some cases the extremely rapid analgesic effect showed that this property did not necessarily accompany radiosensitiveness of the different varieties of tumors; favorable effect on the tumors was not always the cause of the relief of pain nor correlated with it. In many instances the pain began to diminish during the first day of treatment and had entirely disappeared by the time the course of treatments had been completed, although the tumor had not disappeared until a few weeks later. These cases are but a few of a large number that have come to the attention of the author in which this property of the roentgen ray gave relief from pain which was possible in no other way. The tumors were of many kinds and the treatments varied accordingly, but the analgesic property was noted in a wide variety of conditions. The radiosensitiveness of the tumor appears to bear some relation to this effect, but not entirely nor in all cases. In many cases, most cases, in fact, the analgesic effect resulted long before the therapeutic effect on the tumors could be expected. It must be assumed that pain was caused by some kind of pressure on the sensory nerves, and that the roentgen treatment relieved in some way the particular pressure involved. In the case of furuncles and carbuncles, the accumulation of lymphocytes which accompany the condition may be reduced by roentgen treatment and thus relieve the pressure which they produce. In other cases, the only explanation possible is that the roentgen ray has a specific action on the nerve cells. Whatever the explanation may be, it is true that roentgen-ray treatment does exert an analgesic effect and in very many cases offers a prompt means of relieving pain.

Hickey, Preston M. Post-graduate instruction in roentgenology. *Radiology*, May, 1927, viii, 379–383.

The author expresses very clearly the requirements of post-graduate instruction in roentgenology. The teaching of this subject to graduates in medicine is discussed under three subheadings: teaching the important facts of roentgenology to the general practitioners who wish to use this information in their own practice; teaching to specialists who wish to use it in their specialties; and teaching those who expect to become specialists in roentgenology. Medical centers should realize their responsibilities and obligations in this regard and should be certain that they are giving all the attention possible to this subject. The general practitioner of the future will have almost, if not quite as much use for a knowledge of roentgenology as he has for the microscope, and even today he experiences demands for this additional equipment in his regular practice. The specialist is in even greater need of the aid of roentgenology, and in the future, even as at the present time, he will find it much more convenient and time-saving to do the greater part of his roentgenologic work himself instead of sending his patients to a specialist in roentgenology. Graduate instruction should be planned to make courses for such specialists even more thorough than those given the general practitioner. The most serious problem, however, is in providing proper instruction to the graduate in medicine who is to make a specialty of roentgenology. Here it is necessary to require at least two years' study in intensive and extensive preparation. For this purpose, the teaching equipment should be of the best and hospital facilities adequate. A large teaching hospital is essential for best instruction. The author then offers some ideals for such a special course, but admits that at present it is not possible to secure all these advantages in a single institution. The University of Cambridge, England, approaches most nearly this ideal, and there a special diploma in radiology is offered. The courses leading up to this degree are, of course, especially planned and are very thorough. American medical schools would do well to follow this example and approach the problem in a serious, thorough manner.

Klein and Gaertner. The erythema dose in r units for radiations used in superficial therapy. *Fortschr. a. d. Geb. d. Röntgenstrahlen*, 1926, xxxv, 492–505.

The utility of the r unit is not impaired by the fact that the erythema dose as well as ionization chamber readings vary with the wave length. The necessity for considering recoil scattering exists for every intensity measurement of primary radiation, no matter by what method. The intensity measured at the surface is found to be 2 to 3 per cent greater

according to the radiation when the ionization chamber is placed below the surface instead of upon it. The recoil scattered radiation for the rays investigated (up to 3 mm. Al filter) originates almost entirely from a depth up to 10 cm. below the surface. The recoil scattering for a field 1 sq. cm. in size amounts to less than 1 per cent. The skin dose measured in R units was found in the range investigated (0.0 to 3.0 mm. Al, 100 kv., maximum voltage from intermittent direct current) to be independent of the filtration and was on the average: 380 R for a small field (1 sq. cm.) measured at the primary position; 380 R for larger fields (from about 50 sq. cm. up) measured at the surface; about 300 R for fields of 100 sq. cm. up measured in the primary beam.

In another paper a study will be presented as to the relation of the recoil scattering and erythema dose to the voltage and to different filters. The range between 100 and 120 kv. is of particular interest in this respect. From experience, it appears that the characterization of the radiation by maximum voltage and filtration is adequate. At any rate, this loses some of its significance owing to the fact that the erythema dose in R units remains constant throughout the range of voltages studied. In addition, the problem of superficial therapy with the characteristic rays of the elements remains to be investigated.

Kloiber, Hans. Modification of the Heyden sliding frame for duodenal exposures. *Fortschr. a. d. Geb. d. Röntgenstrahlen*, 1926, xxxv, 448–450.

The rear part of the frame is altered by removal of the iron plate and substitution of a lead plate 40 × 60 cm., and 2 mm. thick. The latter has a window cut in it 9 × 24 cm. in size, 34 cm. from the upper edge and 8 cm. from each side. Over this window there is placed a 16 × 47 cm. wooden slide, traveling in suitable runners and covered in front with a layer of 2 mm. of lead. In the middle of the slide is a hole 12 cm. in diameter upon which is fixed a lead lined cylinder 4 cm. deep. The front of the frame remains unaltered. This arrangement permits the taking of 4 serial roentgenograms upon a single 18 × 24 cm. film. There is one disadvantage in the use of this apparatus, namely, that it must be employed only with the patient in the upright position.

Landauer, R. S. The use of dental films in the determination of stray radiation. *Radiology*, June, 1927, viii, 512–517.

In order to illustrate the necessity for protection from stray radiation, dental films were exposed to known fractional parts of the erythema dose and photographs of these developed films reproduced to show this effect. Starting with Mutscheller's standard tolerance dose (1 per cent of an erythema dose per mouth), the author made films representing fractions of the erythema dose from 0.02 per cent to 1.2 per cent. From these films the roentgenologist has a guide by means of which he can estimate the amount of radiation he is receiving in terms of erythema dosage.

Another set of films were exposed to unfiltered radiations and these described in terms of a MacKee erythema. It is shown that less unfiltered than filtered rays may be tolerated. Photographs of these films are presented. Further details of the methods of exposure, etc., are also given. These films offer a very convenient guide to the roentgenologist for determining stray radiation.

Lindsay, George A. Studies in the physics of the X-rays for students in medicine. *Radiology*, May, 1927, viii, 387–393.

The author gives some experiments which are used in the teaching of the underlying principles of the physics involved in roentgenology. These experiments have to do with simple discharge tubes, measurement of high voltage, characteristics of gas-filled tubes, Coolidge tube and factors affecting its output, comparison of roentgen-ray apparatus for treatment purposes, relation between physical and biological doses, coefficient of absorption of roentgen rays, etc. These experiments serve to give the student a better understanding of the principles involved than would uncorrelated instruction in general physics, or even in phases of the subject closely related to roentgenology. They are practical, require the minimum of time and serve the purpose admirably.